FLORA OF PANAMA

Part IV. Fascicle 5*

NYMPHAEACEAE

By J. A. DUKE

Partially or completely submerged rhizomatous aquatics, caulescent or acaulescent, with laticiferous vessels, air spaces and scattered vascular bundles devoid of cambium and vessels, often with idioblasts. Leaves opposite or alternate, the submerged leaves often dissected, the floating leaves more often entire, long-petiolate, often peltate, the venation palmate, with frequent dichotomies or trichotomies, often reticulate. Flowers often large and showy, long-pedicellate, usually solitary, regular, hypogynous to perigynous or epigynous, cyclic to spiral, 3- to 5(-7)-merous. Sepals 3-5(-7), free or slightly connate basally, like or unlike the petals. Petals 3-many, free or slightly connate basally, often brightly colored, occasionally grading into the stamens. Stamens 3-many, the anthers sessile or borne on long, often basally dilated, filaments, entire or apiculate. Carpels 3-many, apocarpous or syncarpous, superior to inferior, with 1-many orthotropous to anatropous ovules attached to the inner wall or pendulous from the summit of the carpel. Fruit a nut, pod or berry, the mature carpels indehiscent, the seeds arillate or naked, smooth or echinate, albuminous or exalbuminous.

A casual perusal of the above description discloses the heterogeneity of this family, a tropical and temperate group of about nine aquatic genera, several of them cultivated. Noting that the characters which hold the family together are largely a function of environmental adaptations while more fundamental characters are quite contrasting, (e.g., inferior vs. superior ovary, cyclic vs. whorled floral arrangement, albuminous vs. exalbuminous seeds, arillate vs. exarillate seeds), Li (in Am. Midl. Nat. 54: 33. 1955) has redistributed the members of Nymphaeaceae *sensu lato* among five families, two of which incur ordinal status as well. Although there is no small amount of logic in Li's disposition, it seems best to retain the Nymphaeaceae *sensu lato* for the Flora of Panama, with only two indigenous genera.

* Assisted by a grant from The National Science Foundation.
Issued May 27, 1963.

a. Leaves all entire or dentate; sepals, petals and carpels numerous; anthers introrse; carpels coalescent, the ovules numerous in each locule; fruit indurate. ..... 1. Nymphaea

aa. Some or all of the leaves finely dissected; sepals, petals and usually the carpels 3; anthers extrose; carpels remaining free, the ovules 1-3 in each carpel; fruit baccate ..... 2. Cabomba

1. NYMPHAEA L.

Nymphaea L. Sp. Pl. 510. 1753. partim emend. J. E. Smith in Sibth. & Smith, Fl. Graec. Prodr. 1: 360. 1808-9. nom. conserv.

Castalia Salisb. in Ann. Bot. 2: 71. 1805. nom. rejic.

Rhizomatous, acaulescent, laticiferous, aquatic perennials. Leaves alternate, often polymorphic, long-petiolate; floating leaves ovate to orbicular with a basal sinus; submergent leaves infrequent and emergent leaves rare. Flowers perfect, usually tetramerous, cyclic to spiral, hypogynous to perigynous, often large and showy, white, cyanic or xanthic, floating or emergent on long peduncles arising from the more or less horizontal rhizome; sepals 4(-8), free or slightly connate basally; petals rather numerous, in several series, the inner grading into the stamens; stamens numerous, the outer with petaloid filaments and short broad anthers, the inner with narrower filaments and longer anthers, the anthers all introrse; carpels 3-many, apocarpous to syncarpous, superior or inferior, the carpellary styles radiating from a more or less coalescent disk; ovules numerous, anatropous, pendulous from the inner angles of the carpels. Fruit baccate, mucilaginous, ripening under water, many-seeded, the seeds indurate, operculate, arillate; endosperm scanty, perisperm copious, the embryo minute.

According to Wood (in Journ. Arn. Arb. 40: 98. 1959), the genus contains about 35 species of widespread occurrence (but lacking in New Zealand and the Pacific slope of North America) in quiet, fresh (rarely brackish) waters. After a detailed morphological study of 11 species and two hybrids of *Nymphaea*, Moseley (in Bot. Gaz. 122: 256. 1961) concludes that the arrangement of the floral organs is in transition from spiral to cyclic phyllotaxy, although superficially the carpels, and occasionally other floral parts, appear to be cyclic. For illustrations of some of the Mexican species, the reader is referred to the work of Blackaller (in An. Inst. Biol. Mex. 7: 415. 1937). The genus has not been monographed in entirety since the work of Conard (Carn. Inst. Wash. Publ. 4: 1. 1905). The reader should consult that monograph for some of the synonymic intricacies of the three species found in Panama.

a. Flowers opening by day; carpels free at the sides, the wall between ovary cells being double, the styles short and stout; filaments prominently produced beyond the anthers; leaves coarsely dentate, black-spotted beneath, at least when young ..... 1. N. ampla

aa. Flowers opening by night; carpels fused at their sides, the wall between ovary cells being single, the styles long and clavate; filaments scarcely produced beyond the anthers; leaves entire to dentate, pallid or cyanic below.

b. Leaves coarse, sinuate to dentate, usually cyanic below; petioles and peduncles not villose near their apex; sepals conspicuously lineolate ..... 2. N. rudgeana

bb. Leaves thin, entire, pallid below; petioles and pedicels occasionally villose apically; sepals obscurely lineolate ..... 3. N. blanda

1. NYMPHAEA AMPLA (Salisb.) DC. Syst. Veg. 2: 54. 1821.

Castalia ampla Salisb. Parad. Lond. 1: *pl. 14.* 1805.

Rhizomatous, aquatic, perennial herbs. Leaves alternate, large and coarse, long-petiolate, the petioles glabrous, the blades suborbicular, sinuate-dentate, green above, purplish and often mottled below, 10-45 cm. long, 10-45 cm. broad, the sinus 5-15 cm. deep; venation coarse, of about 13-29 main veins, these ultimately dichotomizing and trichotomizing and reticulate. Flowers long-pedunculate, usually emersed, opening by day, white, 8-16 cm. broad, the peduncles glabrous; sepals 4, lance-oblong, obtuse to acute, green with purplish striations, 6-10 cm. long; petals several, lance-oblong, obtuse, white, the outermost occasionally yellow-green; stamens numerous, 1-5 cm. long, the outermost longer and broader, the anthers about half as long as the filaments, the filaments conspicuously produced beyond the anthers; carpels ca. 20, laterally connivent, the wall between carpels being double, the styles short, stout and more or less acute, 4-6 mm. long. Fruits 2-3 cm. broad, 1.5-2.5 cm. high, probably maturing under water, pulpy, irregularly dehiscent, many-seeded, the seeds dull gray, operculate, subglobose, ca. 1 mm. broad, slightly longer than broad, strigillose in rows.

Southern Texas and Mexico through the West Indies and Central America to South America. Called "duckweed" by the Barbadians.

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 652, Marjorie Brown 32, 59, Otis Shattuck 366, 836, C. L. Wilson 39, Woodworth & Vestal 562* [annotated by Fassett as var. *speciosa* (Mart. & Zucc.) Casp.]; among the floating islands, north arm of Gigante Bay, *Dodge 3481;* deep water, Gatún Lake, *Killip 3382;* pond west of the Chagres River, opposite Bohío, alt. 20-40 m., *Maxon 4779;* border of lake, Chagres River, at junction of Aguardiente & Quebrada rivers, *Maxon 6562;* between Miraflores and Corozal, alt. 20-30 m., *Pittier 2204;* around Culebra, alt. 50-150 m., *Pittier s. n.;* floating in water, Darién Station, *Standley 31563.* PANAMÁ: swamp between El Jagua Hunting Club on R. Jagua and El Congor Hill, 2 m., *Hunter & Allen 485.*

In addition to the above cited specimens should probably be cited the leaf of *Woodson & Schery 954* from the vicinity of Madden Lake. The leaf is about 30 cm. long with deeply sinuate-dentate margin, the teeth being as much as 6 mm. long and conspicuously apiculate. Mottling is not evident, but this character is supposed to be constant only in younger leaves. The leaf can be matched perfectly among the other specimens cited for *N. ampla* but the flowers, although a little large, obviously belong to *N. rudgeana.* One might assume that this mixed collection results from collecting the leaf of one species and the flower of another, or from hybridization. The former explanation is probably correct, since the two species involved belong to different subgenera and do not hybridize (see Wood, in Journ. Arn. Arb. 40: 98. 1959).

2. NYMPHAEA RUDGEANA G. F. W. Mey. Prim. Fl. Esseq. 198. 1818.

Castalia rudgeana (G. F. W. Mey.) Britt. & Wils. Sci. Surv. P. R. & Virg. Isl. 5: 305. 1924.

Rhizomatous, aquatic, perennial herbs. Leaves alternate, large and rather coarse, long-petiolate, the petioles glabrous, the blades suborbicular, entire to sinuate-dentate, green above, purple below, 10-30 cm. long, 10-30 cm. broad, the

sinus 2-10 cm. deep; venation prominulous to coarse, of about 7-19 main veins, these ultimately dichotomizing and trichotomizing and reticulate. Flowers long-pedunculate, floating or emersed, opening by night, white, 5-15 cm. broad, the peduncles glabrous; sepals 4, lance-ovate, obtuse to acute, green with purplish striations, 3-7 cm. long; petals several, lance-oblong to obovate, obtuse, white or tinged with yellow; stamens numerous, 1-4 cm. long, the outermost longer and broader, the anthers about half as long as the filaments, the filaments scarcely produced beyond the anthers; carpels ca. 20, laterally connate, the wall between carpels being single, the styles long and clavate, 5-12 mm. long. Fruits 2-3 cm. broad, 1.5-2.5 cm. high, probably maturing under water, pulpy, irregularly dehiscent, many-seeded, the seeds dull gray, operculate, subglobose, ca. 1.6 mm long by 1.2 mm. broad, strigillose in rows.

Central America, West Indies and northeastern South America

CANAL ZONE: floating in edge of canal, Gamboa, *Standley 28445* (sterile); vicinity of Madden Lake, *Woodson & Schery 954* (flower only). PANAMÁ: pool in savannah along road between Panama and Chepo; *Dodge, Hunter et al 16713.*

3. NYMPHAEA BLANDA G. F. W. Mey. Prim. Fl. Esseq. 201. 1818.

Castalia blanda (G. F. W. Mey.) Lawson, in Proc. Roy. Soc. Canad. 4: 117. 1888.

Rhizomatous, aquatic, perennial herbs. Leaves radical, mediocre, long-petiolate, the blades subcordate, entire, green above and below, 5-15 cm. long, 3-10 cm. broad, the sinus 1-5 cm. deep; venation delicate, of about 7-13 main veins, the secondaries obscure; petioles glabrous (in Panama) or apically provided with septate hairs. Flowers long-pedunculate, immersed (fide Pittier) to emersed, opening by night, white, 4.0-9.5 cm. broad, the peduncles glabrous or apically provided with septate hairs; sepals 4, lance-ovate, obtuse to acute, green, minutely lineolate, 3-5 cm. long; petals several, lance-oblong to narrowly obovate, white; stamens numerous, 1.0-2.5 cm. long, the outermost longer and broader, the anthers about half as long as the filaments, the filaments scarcely produced beyond the anthers; carpels ca. 20, laterally connate, the wall between carpels being single, the styles obclavate, 5-12 mm. long. Fruits 1.5-2.5 cm. broad, 1-2 cm. high, probably maturing under water, pulpy, irregularly dehiscent, many-seeded, the seeds dull gray, operculate, subglobose, ca. 1.5 mm. long by 1.2 mm. broad, strigillose in rows.

Central America to northeastern South America.

CANAL ZONE: Barro Colorado Island, *Ebinger 553, Shattuck 1153.* COCLÉ: pools and their margins in wet llanos between Aguadulce & Antón, ca. 15-50 m., *Woodson, Allen & Seibert 1225.* PANAMÁ: swamps bordering heavy wooded tract along road between Panamá & Chepo, *Dodge, Hunter et al 16712;* water hole at edge of woods near Tapía River, Juan Díaz region, *Maxon & Harvey 6668;* Camino del Boticario, near Chepo, alt. 30-50 m., *Pittier 4560;* Agricultural Experiment Station at Matías Hernández, *Pittier 6805.*

Fassett has proposed, at least on annotation labels, the reduction of *N. fenzliana* and *N. jamesoniana* to forms of *N. blanda,* the typical form of which is characterized by having the petioles and pedicels apically villose and seems to be lacking in the Central American specimens at hand. Fassett's proposal seems

Figure 142. *Nymphaea blanda*

justifiable enough; the specimens cited here as *N. blanda* seem quite homogeneous, although referred by Fassett to two unpublished forms.

2. CABOMBA Aubl.

Cabomba Aubl. Pl. Guian. Fr. 1: 321, *t. 124.* 1775.

Nectris Schreb. Gen. 1: 237. 1789.

Villarsia Neck. Elem. 2: 110. 1790.

Mostly submerged, slender, caulescent and rhizomatous, mucilaginous, aquatic herbs. Leaves monomorphic to polymorphic; submerged leaves opposite or ternate, long-petiolate, the blades dissected into 5-9 trichotomizing or dichotomizing segments, the ultimate divisions more or less linear; floating leaves when present alternate, peltate, bifurcate, linear-elliptic to ovate. Flowers trimerous, perfect, cyclic, hypogynous, solitary on long axillary pedicels, ultimately floating, white to yellow or purple; sepals 3, slightly connate at the base; petals 3, slightly connate at the base, unguiculate, often auriculate; stamens 3-6, the filaments slender, the oblong anthers extrorse; carpels 1-4, free, each with 3 pendulous ovules, the styles longer than the capitate stigmata. Fruiting carpels diverging, each usually with 3 seeds, the seeds elongate, with hygroscopic processes, the embryo surrounded by a small layer of endosperm and a copious perisperm.

As revised by Fassett (in Castanea 18: 116. 1953), this New World genus consists of seven species, of which only the following is known to occur in Panama.

1. Cabomba piauhyensis Gardn. in Hook. Ic. 7: *t. 641.* 1844.

Cabomba pubescens Ule, in Notizbl. 4: 293. 1915.

Cabomba piauhyensis f. *albida* Fassett, in Castanea 18: 123. 1953.

Slender, caulescent, rhizomatous aquatics, the stem villosulous with moniliform hairs, the rufous roots arising adventitiously from the lower nodes. Submerged leaves opposite or rarely ternate, the dissected blades flabellate in outline, 3-7 cm. long, 3-8 cm. broad, with 5-9 freely dichotomizing and trichotomizing divisions, the ultimate segments linear, 0.1-0.3 mm. broad, with weak subparallel venation, the petioles 1-3 cm. long; floating leaves, when present, narrowly to broadly elliptic. Flowers pink, purplish or white, tending toward yellow in the center, solitary on long axillary pedicels; sepals 3, oblong to obovate, obtuse, glabrous, exauriculate and exunguiculate, almost nerveless, 3-8 mm. long, 1-3 mm. broad, scarcely if at all connate; petals 3, narrowly to broadly oblong, obtuse or rounded, unguiculate, laterally auriculate, 3-8 mm. long; stamens 3-6, 2-5 mm. long, the oblong anthers extrorse; carpels (1-)2-3, 2-5 mm. long, separate, arcuate, glabrous to strigillose, mostly 3-ovulate, the style curved to the truncate or capitate stigma. Fruiting carpels banana-shaped, divergent, 1-3-seeded, the seeds ovoid, papillose, 1.5-2.0 mm. long, 1.0-1.5 mm. broad.

Central America and the West Indies south to northern Brazil and Bolivia mostly at low altitudes.

CANAL ZONE: Chagres River, between Gamboa and Madden Dam, *Curry s.n.;* Río Chagres, *Fairchild 2101*. COLÓN: Juan Mina Plantation, Río Chagres, region above Gamboa, alt. 25 m., *Allen 4129*. PANAMÁ: in pool in swamp bordering savannahs & jungles along road between Panamá & Chepo, *Dodge, Hunter et al 16709;* Agricultural Experiment Station at Matías Hernández, *Pittier* 6858.

All specimens here cited have been annotated by Fassett as *C.. piauhyensis. Pittier 6858* has petals more like those illustrated for *C. palaeformis* Fassett, a closely related species with white, scarcely auriculate petals which reportedly ranges only from southern Mexico to Guatemala. Southward from Panama *C. piauhyensis* is replaced by the yellow-flowered *C. australis* Speg.

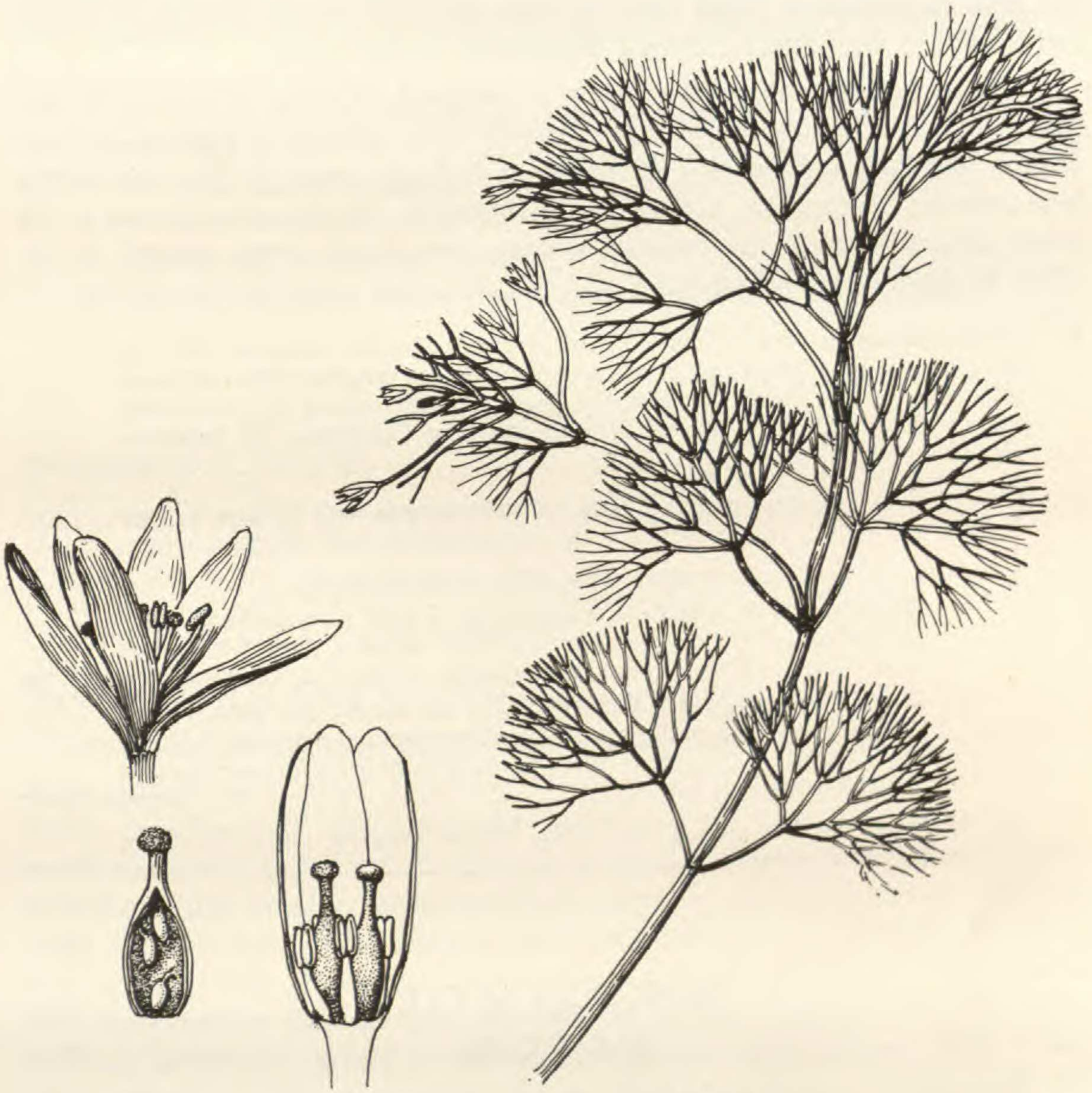

Figure 143. *Cabomba piauhyensis*

CERATOPHYLLACEAE

By J. A. DUKE

Submerged aquatic herbs devoid of stomata, cuticle and roots, Leaves verticillate, 6-12 at a node, dichotomously dissected, minutely denticulate, often tipped by a pair of bristles. Flowers monoecious, usually solitary at the node, axillary to one of the members of the whorl. Staminate flowers involucrate, lacking a true perianth, the stamens 10-20, extrorse, the anthers 4-locular, the pollen acolpate. Pistillate flowers involucrate, devoid of true perianth, the ovary 1-locular, the style filiform, the stigma lateral, the single ovule orthotropous. Fruit an achene capped by the persistent style and often with other spinescent processes, the seeds exalbuminous, filled with the dicotyledonous embryo devoid of radicle and hypocotyl, the plumule bearing recognizable foliage leaves.

A more or less cosmopolitan family of one genus (*Ceratophyllum*) with four North American species, two of them certainly to be expected in Panama on basis of their distribution, although I am unable to find any reports of the genus having been collected in Panama. In view of the limited distribution of a revision of the North American species by Fassett (in Com. Inst. Trop. Invest. Cientif. 2: 25. 1953) his key is here reproduced:

a. Leaves commonly once or twice forked or rarely simple; marginal teeth on leaf-segments on a broad base of green tissue; fruit not winged, with a terminal spine and 2 basal spines that may be long or much reduced [United States and contiguous Canada; Mexico; Greater Antilles; Guatemala, El Salvador, Honduras; South America] ..... 1. C. DEMERSUM L.

aa. Leaves 2-4 times forked; marginal teeth on leaf-segments with little or no base of green tissue; fruit with a narrow wing and sometimes with marginal spines:

b. Body of fruit 3 mm. or more wide, with marginal spines:

c. Margin of fruit with 8-14 spines mostly 2 mm. or more long; spray of leaves 2-4 cm. in diameter; terminal segments with 3-8 obscure teeth [eastern United States; northeastern Mexico] .... 2. C. ECHINATUM A. Gray

cc. Margin of fruit with 16-18 teeth that are mostly less than 1 mm. long; spray of leaves 5-9 cm. in diameter; terminal segments of leaves with 10-20 clearly marked teeth [Guatemala, El Salvador; northeastern South America; Trinidad] ..... 3. C. LLERENAE Fassett

bb. Body of fruit less than 2 mm. wide, without marginal spines [southern peninsular Florida] ..... 4. C. FLORIDANUM Fassett

RANUNCULACEAE

By J. A. DUKE

Perennial or annual herbs with usually opposite, often compound leaves, or lignescent vines with opposite, compound twining leaves; stipules usually absent; petioles not infrequently clasping. Flowers perfect, monoecious or dioecious, actinomorphic or rarely zygomorphic, solitary, racemose or cymose, the floral parts often spirally arranged. Sepals 3-15, separate, imbricate (valvate in *Clematis*), often caducous, the inner often petaloid. Petals as many as or more than the sepals,

occasionally absent and then the sepals petaloid, often with nectariferous glands. Stamens numerous, spirally arranged, separate, hypogynous, the anthers usually 2-celled, introrse, basifixed, longitudinally dehiscent. Carpels 1 to many, separate (connate in *Nigella*), 1-locular, 1-many-ovulate, the ovules anatropous; styles slightly bifid or absent, the stigmata then sessile. Fruit an achene, follicle, or rarely a berry, the seeds albuminous, the embryo small.

A more or less cosmopolitan group, more frequent in temperate and arctic regions, the buttercup family consists of about 30 genera. Although the family contains a few poisonous and medicinal species, its chief economic value is the large number of hardy ornamentals. In highland Central America, species of *Aquilegia, Anemone, Delphinium, Nigella* and *Ranunculus* are cultivated in flower gardens, but only three genera are known to occur naturally in Panama.

a. Lignescent vines climbing by means of foliar tendrils; leaves opposite, compound; flowers dioecious or polygamo-dioecious; achenes with an elongate plumose style ..... 1. CLEMATIS

aa. Herbs; leaves radical or alternate, simple or compound; flowers perfect or polygamous; achenes without a plumose style

b. Leaves with 1-9 leaflets; flowers yellowish; petals present ..... 2. RANUNCULUS

bb. Leaves with many leaflets; flowers greenish or whitish; petals absent ..... 3. THALICTRUM

1. CLEMATIS L.

CLEMATIS L. Sp. Pl. 543. 1753.
Atragene L. l.c. 1753.
Muralta Adans. Fam. 2: 460. 1763.
Viticella Dill. ex Moench, Meth. 296. 1794.
Naravelia DC. Syst. 1: 167. 1818.
Viorna Reichb. Handb. 227. 1837.
Cheiropsis Spach, Hist. Veg. Phan. 7: 260. 1839.
Meclatis Spach, loc. cit. 272. 1839.
Sieboldia Hoffmgg. ex Heynh. Nom. 2: 665. 1846.

Dioecious or polygamo-monoecious, lignescent vines, climbing by means of foliar tendrils (in Central America). Leaves opposite, exstipulate, ternately, pinnately or biternately compound, the leaflets entire to coarsely dentate, often asymmetrical, 1- to 5-plinerved, glabrous to densely sericeous, the rhachis usually pubescent, often twining. Inflorescences of cymes or umbels racemosely disposed along the bracteate, often elongate main axis, unisexual or polygamous; sepals 4-5, valvate, white, greenish or purplish, often petaloid; stamens numerous, separate, the filaments flattened and elongate, the anthers basifixed, 2-celled, longitudinally dehiscent; carpels numerous, separate, the styles comose. Fruit a dry arcuate-ellipsoid achene terminated by the elongate indurate, hirsute style, the ovule pendulous on the dorsal raphe.

Several ornamentals exist in this widespread temperate and tropical genus of both hemispheres. Only the monographer could say how many species there are; the first volume of the Index Kewensis devoted seven and a half columns to the genus. Extreme variability in the leaves, indument and sexuality have resulted

in a rapid increment of named species, many of which, at best, deserve only formal status. The South American species recently have been treated by Lourteig (in Darwiniana 9: 397. 1951, and in Mem. Soc. Cien. Nat. La Salle 16: 19. 1956). Three elements occur in Panama, and I am handling them in the status which I believe would have been assigned them by Lourteig, although the differences between them are by no means constant.

a. Leaflets densely sericeous, coarsely dentate with 2-6 teeth per side, often basally cordate .....1. C. HAENKEANA

aa. Leaflets glabrescent, entire or with fewer teeth, basally rounded or truncate ..2. C. DIOICA

1. CLEMATIS HAENKEANA Presl, Rel. Haenk. 2: 69. 1835

Clematis sericea Humb. & Bonpl. ex DC. Syst. 1: 144. 1818, not Michaux 1803.
Clematis grossa Benth. Pl. Hartw. 33. 1840.
Clematis grahami Benth. loc. cit. 5. 1840.
Clematis polycephala Bertol. Fl. Guat. 424. 1840.
Clematis populifolia Turcz. in Bull. Soc. Nat. Mosc. 27: 272. 1854.
Clematis thalictroides Steud. in Flora 39: 407. 1856.
Clematis goudotiana Pl. in Tr. & Pl. in Ann. Sc. Nat. ser. 4. 17: 10. 1862.
Clematis medusae Pl. & Linden, loc. cit. 11. 1862.
Clematis floribunda Tr. & Pl. loc. cit. 9. 1862.
Clematis dioica L. subsp. *sericea* (H. & B. ex DC.) Benoist, in Bull. Soc. Bot. France 87: 124. 1940.
Clematis rhodocarpa Rose, in Contr. U. S. Nat. Herb. 10: 95. 1906.

Dioecious or polygamo-dioecious, perennial, lignescent vines, climbing by means of the foliar tendrils, the branches reddish-brown, striate, often sericeous. Leaves opposite, 3- to 5-foliate, the leaflets sericeous, at least below, often glabrescent, narrowly to broadly ovate, apically acute to acuminate, basally truncate to cordate, coarsely and often asymmetrically dentate with apiculate teeth or lobes, 3-10 cm. long, 2.5-8.0 cm. broad, with 3-9 veins arising palmately at or near the base, the petiolules 1-5 cm. long, the petioles mostly 5-10 cm. long, the sericeous rhachis often coiling. Staminate inflorescences of axillary and terminal compound dichasial cymes, the main axis often elongate and terminating in a simple cyme, giving off 3-7 pairs of simple or compound cymes, the main branches bracteate, sericeous throughout, the bracts progressively reduced; sepals 4, oblong-obovate, apically obtuse; 3-nerved, marginally involute, 6-9 mm. long, 3-4 mm. broad; stamens numerous, 3-7 mm. long, the filaments flattened, the anthers basifixed, 2-celled, 0.6-0.8 mm. long, longitudinally dehiscent, the outer stamens usually longer and perhaps infertile; pistillodes plumose when present. Carpellate inflorescences as the male, the sepals 4, early caducous, 3-ribbed, marginally involute, 6.5-9.0 mm. long, 3-4 mm. broad; carpels numerous, the ovary 1-2 mm. long, arcuate-ellipsoid, pubescent, the plumose style 5-10 mm. long. Mature achenes compressed-ellipsoid, flanged, 2.0-3.5 mm. long, 1-2 mm. broad, reddish-brown, the elongate style plumose with hairs to 4 mm. long.

Mexico through Central America to Argentina, apparently confined to higher elevations in the tropics.

CHIRIQUÍ: vicinity of Cerro Punta, 2000 m., *Allen 1523*. COCLÉ: vicinity of El Valle de Antón, 600 m., *Allen 2062*.

Several colloquial names have evolved for this species in Central America, among the most interesting of which are *barba de viejo, cabello de ángel,* and *bejuco de crispillo,* the latter probably in allusion to the fibrous qualities causing the plant to be used as cordage. The acrid juices of the plant are capable of inducing blisters and find occasional use as a poultice.

2. CLEMATIS DIOICA L. Syst. 10: 1084. 1759.

Clematis americana Mill. Dict. No. 14: 1768.
Clematis brasiliana DC. Syst. 1: 143. 1818.
Clematis glabra DC. loc. cit. 1818.
Clematis caracasana H. & B. ex DC. Syst. 1: 141. 1818.
Clematis havanensis H. & B. ex DC. loc. cit. 152. 1818.
Clematis caripensis HBK. Nov. Gen. & Sp. 5: 36. 1821.
Clematis integra Vell. Fl. Flum. 241. 1825.
Clematis discolor Gardn. in Hook. Jour. Bot. 2: 330, 1843.
Clematis dioica var. α antillensis Eichl. in Mart. Fl. Bras. 13¹: 147. 1864.
Clematis dioica var. *β brasiliana* (DC.) Eichl. loc. cit. 148. 1864.
Clematis dioica var. *americana* (Mill.) O. Ktze. in Verh. Bot. Ver. Brandenb. 26: 103. 1885.

Dioecious or polygamous lignescent vines climbing by means of foliar tendrils, the branches reddish-brown, striate, often pilose. Leaves opposite, with three (or more in var. *brasiliana*) leaflets, glabrate or pilose below, falcate-ovate, entire or with 1 or 2 apiculate teeth, apically acute to long-acuminate, basally rounded to subcordate, 2-8 cm. long, 1.5-5.0 cm. broad, with 3-5 nerves arising near the base, the petiolules 1.0-2.5 cm. long, the petioles to 8 cm. long, glabrous or pilose, the rhachis often coiling. Staminate flowers in axillary and terminal simple or compound dichasial cymes, the pedicels 10-30 mm. long, all branches subtended by progressively reduced bracts, glabrous or pubescent; sepals 4, oblong-obovate, 3-nerved, apically obtuse, marginally involute, 7-11 mm. long, 3.5-5 mm. broad; stamens numerous, the outer longer and perhaps infertile, the anthers basifixed, 2-celled, 0.7-1.0 mm. long, longitudinally dehiscent; filaments flattened; pistillodes plumose when present. Carpellate inflorescences similar to the staminate, the sepals 4, 3-nerved, early-caducous, 6-11 mm. long, 3-5 mm. broad; carpels numerous, ovary 1-2 mm. long, arcuate-ellipsoid, pubescent, the plumose styles 5-10 mm. long. Mature achenes compressed-ellipsoid, flanged, 2.5-4.0 mm. long, 1.0-2.5 mm. broad, reddish-brown, the elongate plumose styles with hairs to 5 mm. long.

Mexico through Central America and the West Indies to southern temperate South America.

CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, *White & White 107* (var. *brasiliana*); Jaremillo, Boquete District, 4500 ft., *Terry 1279* (var. *brasiliana*); between Hato del Jobo and Cerro Vaca, eastern Chiriquí, alt. 700-1000 m., *Pittier 5424* (var. *brasiliana*). COCLÉ: lower portion of valley and marshes along R. Antón, El Valle de Antón, ca. 500 m., *Hunter & Allen 367* (var. *dioica*).

Figure 144. *Clematis dioica*

As Standley and Steyermark pointed out (in Field Mus. Publ. Bot. 24[4]: 247. 1946,) the two species found in Panama are not clearly differentiated, and this obscurity of definition is carried down to the varietal level also; so it is only with reluctance that I refer the specimens of *C. dioica* to variety. The stems of the plant are used as cordage, the sap as a glue, and the seed pods as a kapok.

2. RANUNCULUS L.

RANUNCULUS L. Sp. Pl. 548. 1753.

Ficaria Huds. Fl. Angl. 1: 213. 1762.
Hecatonia Lour. Fl. Cochinch. 1: 302. 1790.
Ceratocephala Moench, Meth. 218. 1794.
Krapfia DC. Syst. 1: 228. 1818.
Batrachium (DC.) S. F. Gray, Nat. Arr. Brit. Pl. 2: 720. 1821.
Casalea St. Hil. Fl. Bras. Mer. 1: 6, *pl. 1*. 1824.
Aphanostemma St. Hil. loc. cit. 10. 1824.
Oxygraphis Bunge, Verz. Suppl. Alt. 46. 1836.
Cyrtorhyncha Nutt. ex T. & G. Fl. N. Am. 1: 26. 1838.

Flammula Dod. ex Fourr. in Ann. Soc. Linn. Lyon 2[16]: 324. 1868.
Coptidium Nyman, Consp. 13. 1878.
Kumlienia Greene, in Bull. Cal. Acad. 1: 337. 1886.
Arcteranthis Greene, in Pittonia 3: 190. 1897.
Beckwithia Jepson, in Erythea 6: 97. 1898.
Halerpestes Greene, in Pittonia 4: 207. 1900.
Rhopalopodium Ulbrich, in Notizbl. 8: 253. 1922.
Aspidophyllum Ulbrich, loc. cit. 268. 1922.

Glabrous to pubescent erect or procumbent herbaceous annuals or perennials, the stems occasionally rooting at the nodes, the roots fibrous, fascicled. Leaves radical or cauline, exstipulate, entire, dissected or compound, alternate or rarely opposite, glabrous to pubescent, often with acrid juice. Inflorescence terminal, the flowers perfect; sepals 5(-3-6), imbricate, caducous; petals (0-)5(-26), yellow, white or red, separate, with a nectariferous pit at the base, unguiculate; stamens commonly 10, often more, rarely fewer; anthers 2-celled, basifixed, longitudinally dehiscent; carpels 5-many, the single ovule attached near the base of the cell. Achenes capped by the elongate style, glabrous or hairy, smooth or variously ornate.

Comprised of about 250 species in temperate and subarctic regions of both hemispheres, the buttercup genus is represented in Central America by few species, most of them confined to moderately high elevations. In his recent monograph of the North American species, Benson (in Am. Midl. Nat. 40: 1. 1948, and 52: 328. 1954) treats about 100 species. A few species with large petals are cultivated as ornamentals. Two species are reported from Panama.

a. Achenes 20-25, the beak ca. 1 mm. long, recurved; petals 5, at least half as broad as long; stems rooting at the lower nodes; roots ca. 0.5 mm. in diameter ..... 1. R. REPENS

aa. Achenes 10-20, the beak 1.5-2.7 mm. long, straight; petals 5-10, more than twice as long as broad; stems not rooting at the lower nodes; roots 1-3 mm. in diameter ..... 2. R. PILOSUS

1. RANUNCULUS REPENS L. Sp. Pl. 554. 1753.

Ranunculus intermedius Eat. Man. Bot. 3: 1822.
Ranunculus repens α *glabratus* DC. Prodr. 1: 38. 1824.
Ranunculus clintonii Beck, Bot. N. & Mid. States 9. 1833.
Ranunculus repens var. *pleniflorus* Fernald, in Rhodora 19: 138. 1917.

Hirsute, prostrate to ascending perennials to 80 cm. tall, rooting at the lower nodes, the roots filiform. Cauline leaves alternate, hirsute, often glabrescent, the blades trifoliate, the leaflets often deeply 3-lobed and dentate, rhombic-deltoid, apically acute and apiculate, basally obtuse to acute, 2-4 cm. long, 1.5-3.0 cm. broad, the central petiolules 0.5-4.0 cm. long; petioles 1-20 cm. long, the swollen leaf base to 2.5 cm. long; radical leaves similar to the cauline but often with larger blades and longer petioles. Flowers mostly solitary in the upper axils, the pedicels 2-10 cm. long; sepals 5, greenish, 3-nerved, 4-7 mm. long, 2-4 mm. broad, caducous; petals 5, yellow, occasionally drying white, ellipsoid, obtuse, 5-13 mm. long, 3.5-10.0 mm. broad, the nectary flap semicircular, glabrous, ca. 0.5 mm. long, (1.0-1.3 mm. fide Benson); stamens numerous, 2-3 mm. long, the anthers about as long as the filaments; carpels numerous. Fruiting heads subglobose, 6.0-7.5 mm.

long; achenes 20-25, subdiscoid, puncticulate, ca. 2.5 mm. long, 2.0-2.5 mm. broad, the beak ca. 1 mm. long, strongly recurved; fruiting pedicels 4-15 cm. long, the receptacle ca. 3 mm. long, pubescent.

Presumably a native of Europe, but widely occurring in both North and South America.

CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, 6000 ft., *Davidson 444;* valley of the upper R. Chiriquí Viejo, vicinity of Monte Lirio, 1300-1900 m., *Seibert 159;* vicinity of Bajo Chorro, 1900 m., *Woodson & Schery 646.*

A Gray Herbarium duplicate of *Woodson & Schery 646* was determined by Benson as *R. repens.* The duplicate in the herbarium of the Missouri Botanical Garden departs from Benson's description of *R. repens* in having unusually small floral parts and fewer carpels and stamens.

2. RANUNCULUS PILOSUS HBK. ex DC. Syst. 1: 287. 1818.

Ranunculus amarillo Bertol. Fl. Guat. 24. 1840.

Hirsute ascending perennials to as much as 70 cm., not rooting at the nodes, the roots fibrous. Cauline leaves alternate, appressed-hirsute, gradually reduced to linear bracts, the blades trifoliate, the leaflets often lobate and dentate, deltoid to rhombic, apically acute, basally attenuate to rounded, 2-10 cm. long, 1-8 cm. broad, the central petiolules to 4 cm. long; petioles 1-10 cm. long, the sheaths mostly 5-15 mm. long; radical leaves similar to the cauline but often with larger blades and longer petioles. Flowers 1-several in terminal lax racemes, the pedicels 2-12 cm. long; sepals 5, greenish-yellow, 5- to 7-nerved, dorsally hirsute, 5-7 mm. long, 2.5-4.0 mm. broad, promptly caducous; petals 5-10, yellow, occasionally drying white, narrowly obovate, broadest above the middle, 8-12 mm. long, 3-5 mm. broad, the nectary flap reniform to semicircular, ca. 1 mm. long; stamens numerous, becoming 4 mm. long, the anthers ca. 1 mm. long; carpels numerous. Fruiting heads subglobose, 7-8 mm. long; achenes 10-20, ellipsoid to discoid, 2.5-3.0 mm. long, 2-3 mm. broad, the beaks 1.5-3.0 mm. long, arcuate; fruiting pedicels 4-15 cm. long, the receptacles 2.5-3.5 mm. long, hispid.

Paludal areas, 4000-8000 ft., Mexico to Panama.

CHIRIQUÍ: rain forest, Bajo Chorro, Boquete District, 6000 ft., *Davidson 444* (GH, fide Benson).

Davidson 444 in the herbarium of the Missouri Botanical Garden is *Ranunculus repens* as determined by Benson.

3. THALICTRUM L.

THALICTRUM L. Sp. Pl. 545. 1753.
Physocarpum Bercht. & Presl, Rostl. 1: 14. 1823.
Ruprechtia Opiz, Seznam 86. 1852, nec C. A. Mey. nec Rchb.
Sumnera Nieuwl. in Am. Midl. Nat. 3: 254. 1914.
Leucocoma (Greene) Nieuwl. loc. cit. 3; 1914.

Glabrous to pubescent erect herbaceous or lignescent perennials, occasionally stoloniferous, the roots mostly fibrous, occasionally tuberous. Leaves radical and

Figure 145. *Ranunculus pilosus*

cauline, the cauline usually alternate, decompound, glabrous to pubescent, with swollen petiolar sheaths. Inflorescences mostly terminal, paniculate or rarely racemose or subcorymbose, bracteate or ebracteate, the flowers perfect, dioecious or polygamous; sepals 4-5(-7), caducous, greenish or petaloid; petals absent; stamens numerous, free, the anthers basifixed, often apiculate; carpels few to many, indehiscent, uniovulate. Achenes few to numerous, more or less saccate, often costate or nerved, the elongate styles frequently deciduous.

Thalictrum is most common in temperate portions of the northern hemisphere, where a few species are handsome enough to be cultivated. In a monograph of the American *Thalictra* and their Old World allies, Boivin (in Rhodora 46: 337. 1944.) treated 112 species and varieties. Only two species are reported from Panama.

a. Plants not glaucous, glabrous; carpels 3.0-3.2 mm. broad .....1. T. VIRIDULUM
aa. Plants glaucous, pubescent with capitate hairs; carpels 2.0-2.2 mm. broad .....2. T. PANAMENSE

1. THALICTRUM VIRIDULUM Boivin, in Rhodora 46: 406. 1944.

Verdant glabrous perennials to 1.5 m. high, the lignescent twigs sulcate. Cauline leaves alternate, glabrous, the blades 3- to 4-times pinnately compound, the pinnae opposite, the ultimate segments mostly 3-lobed, ovate or obovate to reniform or obreniform in outline, often asymmetrical, apically rounded, basally truncate to cordate, 10-22 mm. long, 10-25 mm. broad, the petiolules 5-25 mm. long. Flowers polygamo-monoecious, mostly perfect, some strictly staminate, paniculate, with linear bracts 2-15 mm. long; sepals 4-5, ovate, apically rounded, 5-nerved, 3-4 mm. long, 2.0-2.5 mm. broad, greenish; stamens numerous, pinkish, the filaments 0.5-1.0 mm. long, the anthers basifixed, 1.5-3.0 mm. long; carpels few, pinkish, the body about 1 mm. long, the style 7-10 mm. long, deciduous. Achenes ca. 4.5 mm. long, 3.0-3.5 mm. broad, granular, with a stipe and an apiculum each about 1 mm. long, 3-ribbed, the ribs occasionally branching and anastomosing.

Known only from the type locality.

CHIRIQUÍ: in rocky gorge of river, valley of the upper R. Chiriquí Viejo, vicinity of Monte Lirio, 1300-1900 m., *Seibert 204*.

Boivin's description of this species, based on *Seibert 204* at the New York Botanical Garden, says of the leaves "perfecte 5-ternata." On the specimen at hand, there is no swollen leaf base, so I cannot be sure whether I have a leaf or a leaflet, but it is 3- to 4-times decompound, with only the ultimate divisions ternate, all others being pinnate.

2. THALICTRUM PANAMENSE Standley, in Field Mus. Publ. Bot. 22: 19. 1940.

Glaucous capitate-pubescent perennials to as much as 1.3 m. high, the lignescent twigs shallowly canaliculate. Cauline leaves alternate, capitate-pubescent, the blades 3- to 4-times pinnately compound, the pinnae opposite, the ultimate divisions often ternate or 3-lobed, often asymmetrical, ovate to reniform in outline, apically rounded, basally truncate to cordate, 5-12 mm. long, 5-12 mm. broad, the petiolules 2-8 mm. long. Flowers few, the inflorescence less than 3.5 cm. long, ap-

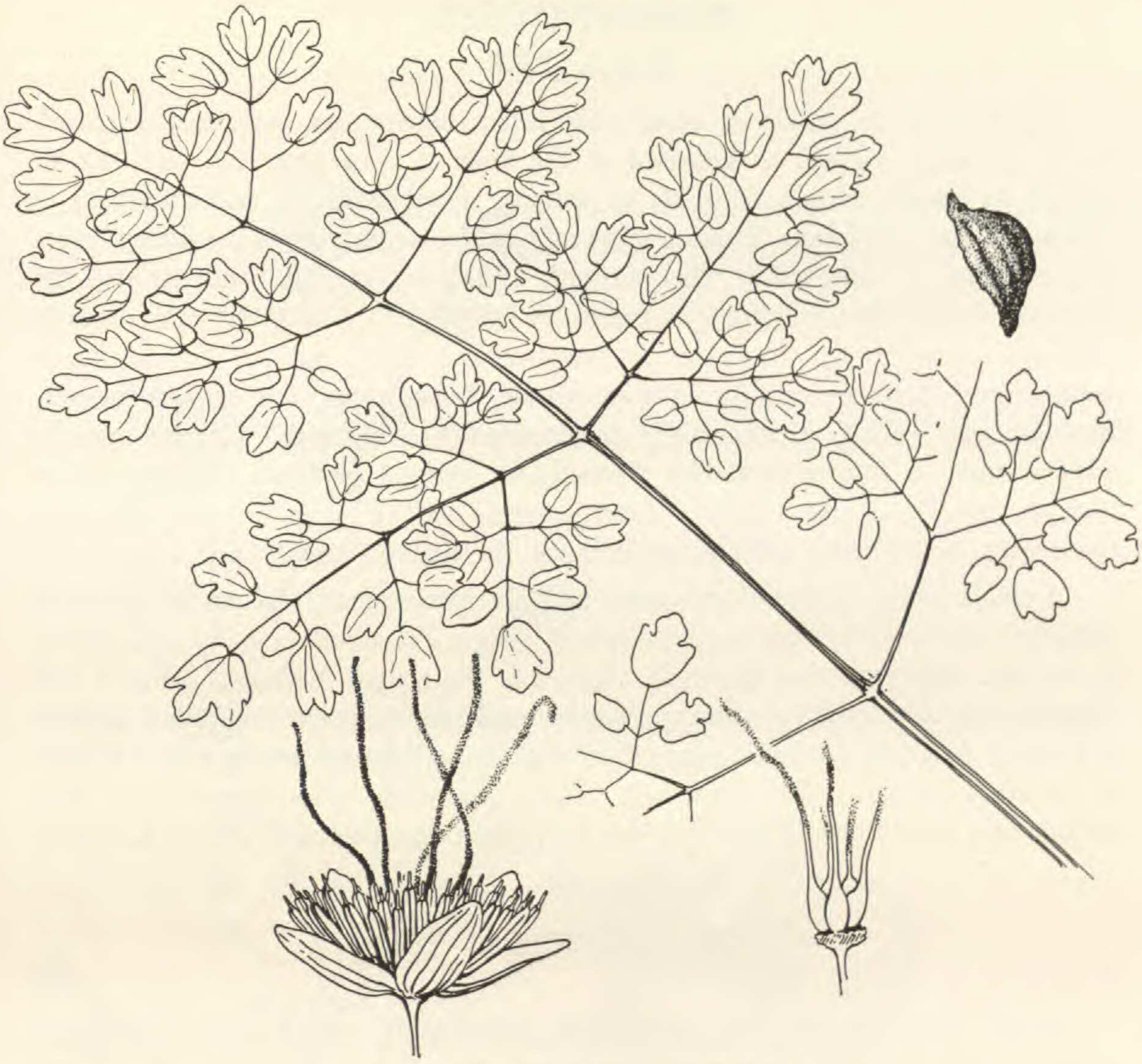

Figure 146. *Thalictrum viridulum*

parently unisexual; sepals (3-)4, ovate, obtuse, 3-nerved, 2.0-2.5 mm. long, ca. 1 mm. broad, promptly caducous; carpels few, the body about 1 mm. long, the style ca. 2 mm. long. Achenes 3.5-4.5 mm. long, 2.0-2.3 mm. broad, glandular-puberulent, stipitate, 3-ribbed, the ribs rarely branching or anastomosing; fruiting pedicels to 15 mm. long.

Known only from the type locality.

CHIRIQUÍ: savannahs, Boquete District, 4500 ft., *Davidson 791*.

BERBERIDACEAE

By J. A. DUKE

Perennial herbs, shrubs or small trees, often rhizomatous, occasionally armed. Leaves alternate, radical or crowded at the ends of spur branches, stipulate or exstipulate, simple, binate, trifoliate or pinnate, membranaceous and deciduous to coriaceous and evergreen. Flowers bisexual, cyclic, actinomorphic, solitary, racemose, spicate or paniculate, the perianth imbricate, usually multiseriate, the outermost whorl often grading into bracteoles (prophylls). Perianth whorls mostly trimerous, occasionally dimerous or pentamerous, often yellow, the segments usually free. Stamens usually in two whorls, hypogynous, the anthers usually bilocular and valvate (occasionally longitudinally dehiscent). Carpels usually solitary, uni- to pluriovulate, the placentation parietal or basal, the styles and stigmata usually simple. Fruit a berry, capsule or rarely an achene, the seeds anatropous, occasionally arillate, albuminous, the embryo straight and small.

A small family of about ten genera and 500 species, mostly of north-temperate latitudes, the Berberidaceae are represented among Panamanian collections solely by *Berberis nigricans* from Chiriquí. Species of the genera *Mahonia*, *Berberis* and *Nandina* are cultivated in temperate regions and might appear in upland gardens of Central America. *Mahonia paniculata*, with imparipinnate leaves with 7-8 pairs of spinulose-serrate leaflets and with broad paniculate inflorescences, has been collected on some Costa Rican volcanoes, and might be expected in upland Chiriquí.

1. BERBERIS L.

Berberis L. Sp. Pl. 330. 1753.

Small, often profusely branched shrubs, occasionally armed with 1- to many-pronged barbs. Leaves simple, often crowded toward the apex of spur branches, membranaceous to coriaceous, deciduous or evergreen, sessile or with a short alate petiole, entire, revolute, or spinose-serrulate, subenervate or with obvious open or reticulate venation, often pruinose and papillose below. Flowers usually yellowish, subglobose, subsessile to long-pedicellate, usually 1- or 2-bracteolate, solitary, fascicled, umbellate, racemose or paniculate, the inflorescence often pedunculate, bracteate; sepals in 2-3 whorls of 3, the outer usually shorter and narrower, the inner usually obtuse, oblong to orbicular, as long as or longer than the petals, eglandular; petals usually in 2 whorls of 3, emarginate or rounded, often unguiculate, usually with a basal pair of glands; stamens hypogynous, antepetalous, the anthers bilocular, valvate, the filaments occasionally subapically dentate, apically truncate or apiculate; ovary 1- to 15-ovulate, the stigma capitate, sessile or provided with a prominent style. Berries ellipsoid to globose, red, purple or black, often pruinose, juicy or rather dry, 1- to few-seeded, the seeds yellowish or cyanic.

For a taxonomic revision of the genera *Berberis* and *Mahonia*, both well endowed with American and Asian species, the reader is referred to the work of Ahrendt (in Jour. Linn. Soc. 57: 1. 1961) in which nearly 500 species of *Berberis*

Figure 147. *Berberis nigricans*

and about 100 species of *Mahonia* are recognized, although no Panama specimens of either genus are cited. Only one species of the often-cultivated genus *Berberis*, has been recorded from Panama.

1. Berberis nigricans O. Ktze. Rev. Gen. 1: 10. 1891.

Profusely branching armed shrubs to as much as 4 m. tall, the rather smooth branches glabrous, armed with 3-pronged barbs as much as 2 cm. long. Leaves crowded on spur branches in the axils of the barbs, the blades coriaceous, evergreen, narrowly to broadly obovate, apically obtuse and apiculate, scantily spinulose, basally cuneate, subsessile, 1.5-7.0 cm. long, 0.8-2.4 mm. broad, lustrous above, pruinose, papillose and often resin-dotted below, the venation reticulate, the alate petioles 0.5-4.5 mm. long. Flowers subglobose, orangish, in bracteate simple or scantily branched racemes terminating the spur shoots; bracts lanceolate, caudate, 2-5 mm. long, the pedicels 3-15 mm. long, usually terminated by 1-2(-3) bracteoles (prophylls) subtending the calyx, the bracteoles deltoid to oblong, acute to acuminate, shorter than the sepals; sepals in 2-3 whorls of 3, the outermost deltoid, acute, 1-2 mm. long, the median and innermost broadly obovate to orbicular, obtuse or rounded, 3-5 mm. long, 2-4 mm. broad, glabrous, obscurely nerved; petals 6, broadly obovate, unguiculate, obtuse, or somewhat emarginate, often cucullate and laterally involute, 3-5 mm. long; stamens 6, 3-4 mm. long, the connectives truncate, the anthers bilocular, valvate; ovary ellipsoid, 2- to 4-ovulate, the stigma capitate, subsessile, the style to 1 mm. long (in Panama). Fruit baccate, blackish with a pruinose bloom, ellipsoid, 6-10 mm. long, the style and stigma to 1.5 mm. long.

Costa Rica and Panama at rather high elevations.

Chiriquí: around El Potrero Camp, Chiriquí Volcano, alt. 2800-3000 m., *Pittier 3074;* Potrero Muleto, Volcán Chiriquí, Boquete District, 10,400 ft., *Davidson 1033.*

It is not apparent from Ahrendt's revision whether or not he saw the type of *B. nigricans*, but I would assume from the terse nature of his description that he had not. No mention is made in his account, or in the original description, of the stout three-pronged barbs which characterize the specimens cited above. In spite of this, the short style, and the tendency of the panicle to have few branches, I feel rather certain of the identity of the Panama specimens, with little more than the geography taken into consideration. No other species are reported from Central America. *B. dealbata* Lindl., described from questionably Mexican material, representing the northernmost extension of the *Australes* group. Judging from Ahrendt's geographical resumé of the section *Truxillenses*, another species occurs in Nicaragua.

MENISPERMACEAE

By D. G. RHODES

Woody or subherbaceous twining or scrambling shrubs, rarely small trees. Leaves alternate, simple, entire to crenate, pinnately or palmately nerved, petiolate, exstipulate. Flowers dichlamydeous, dioecious. Staminate inflorescence axillary, frequently fasciculate, basically cymose, frequently racemiform or paniculiform, rarely spiciform. Staminate flowers actinomorphic: Sepals 2- to 3-merous, usually 6, free or rarely united at the base, imbricate or valvate, the interior cycle usually conspicuously larger than the exterior; petals 2- to 3-merous, usually 6, frequently minute, free or rarely united, imbricate or valvate; stamens opposite and equaling the petals in number, the filaments free or variously coherent, the anthers often immersed within the connective, dehiscing longitudinally. Pistillate inflorescence axillary, frequently fasciculate, cymose or racemose, Pistillate flowers actinomorphic, rarely zygomorphic: Sepals 3-merous, usually 6, rarely reduced to 1; petals usually 6, rarely reduced to 1, usually minute; staminodia frequently 6 or absent; carpels 3 or 6, rarely 1, free or connivent; style often recurved or inconspicuous; stigma lingulate, radiate-incised or 3-lobed; ovule 1, amphitropous. Drupes free, sessile or stipitate, erect or hippocrepiform; exocarp membranous or subcoriaceous; mesocarp more or less pulpy; endocarp chartaceous or osseous, often verrucose and ribbed, rarely smooth; embryo usually curved, rarely erect; albumen copious, scanty or absent, frequently ruminate.

A family of about 70 genera and 400 species. North and South America, Africa, northern Australia, Indo-Malayan region, eastern Asia and the Mediterranean basin.

a. Staminate flower with 6-18 sepals, the petals free, the stamens 6, the filaments more or less connate or free; pistillate flower with sepals and petals similar to the staminate.
  b. Old stems conspicuously lenticellate; leaves as broad as long or nearly so, membranous or subcoriaceous; sepals 6-18.
    c. Staminate inflorescence paniculiform; leaves rarely under 12 cm. long, white and woolly below; carpels 6; drupes 6 (or few aborted), exocarp scarcely fleshy, endocarp chartaceous-coriaceous, essentially smooth, exalbuminous ..... 1. CHONDRODENDRON
    cc. Staminate inflorescence racemiform, rarely paniculiform; leaves rarely over 12 cm. long, pubescent or glabrous below; carpels 3; drupes 1-3, exocarp fleshy, endocarp verrucose-ribbed, albuminous. ..... 2. ODONTOCARYA
  bb. Old stems not conspicuously lenticellate; leaves longer than broad, coriaceous; sepals 6.
    d. Petals so greatly involute as to almost conceal the stamens fixed on the claw; leaves rarely exceeding 10 cm. in length; drupe rarely less than 16 mm. in length, albuminous ..... 3. ANOMOSPERMUM
    dd. Petals moderately involute, not concealing the stamens; leaves rarely less than 10 cm. in length; drupe rarely exceeding 16 mm. in length, exalbuminous ..... 4. HYPERBAENA

aa. Staminate flower with 4 sepals, the petals connate, the stamens 4, the filaments coherent forming a staminal column; pistillate flower with 1 sepal and 1 petal ..... 5. CISSAMPELOS

1. CHONDRODENDRON Ruiz & Pav.

Chondrodendron Ruiz & Pav. Prodr. Fl. Peruv. 132. 1794 (as *Chondodendron*); Miers, in Ann. Nat. Hist. ser. 3. 19: 187. 1867.

Botryopsis Miers, loc. cit. ser. 2. 7:43. 1851.
Detandra Miers, loc. cit. ser. 3. 13:124. 1864.

Twining shrubs. Leaves alternate, petiolate. Staminate inflorescence axillary, fasciculate, paniculiform. Staminate flowers 3-merous, actinomorphic: Sepals 6-22, the exterior minutely bracteoliform, the interior 6 conspicuously larger, usually reflexed or sometimes cucullate at the apex in anthesis; petals 6, minute, antesepalous, appressed to the androecium; stamens 6, antepetalous, greatly surpassing the petals, inflexed, the filaments free or slightly coherent at the base, the longitudinally dehiscing anthers 2-celled, the cells separated by and sometimes immersed within a fleshy connective which is often produced beyond the thecae. Pistillate inflorescence axillary, solitary or fasciculate, racemose. Pistillate flowers: Sepals and petals similar to the staminate; staminodia minute or none; carpels 6, erect, gibbose-ellipsoid, the style almost wanting, the stigma lingulate and reflexed. Drupes 6 or a few aborted, gibbose-ellipsoid; endocarp chartaceous-coriaceous, divided by a septum which extends from the base beyond the center; seed deeply hippocrepiform, exalbuminous.

About 10 species. Panama, South America.

Throughout the literature involving the Menispermaceae Ruiz and Pavón's original spelling *Chondodendron* has been adopted by some authors, including Diels, while others have utilized the form *Chondrodendron*. As pointed out by Sandwith (in Kew Bull. 58. 1955), Ruiz and Pavón stated that they called their new genus *Chondodendron* because of the "abundance of burrs" on the trunk and branches of the "tree," referring to the verrucose-lenticellate cortex of the woody stems. The name therefore clearly must have been derived from the Greek χόνδρος, "burr" and δένδρον, "tree" and the name should be spelled *Chondrodendron*. Sandwith proposes that the original spelling *Chondodendron* be treated as an orthographic error, and that the correct spelling *Chondrodendron* be adopted in the future for this genus. On the basis of the evidence, the spelling *Chondrodendron* is adopted for use in this paper.

1. Chondrodendron tomentosum Ruiz & Pav. Syst. Veg. 261. 1798.

Epibaterium ? tomentosum Pers. Syn. Pl. 2:561. 1807.
Cocculus chondodendron DC. Syst. 1:552. 1818.
Chondodendron scabrum Miers, in Ann. Nat. Hist. ser. 2. 7:44. 1851.
Botryopsis spruceana Eichl. in Flora 47:394. 1864.
Chondodendron cretosum Miers, in Ann. Nat. Hist. ser. 3. 19:192. 1867, *nom. nud.*; Contrib. Bot. 3:312. 1871.
Chondodendron hypoleucum Standl. in Contrib. Arn. Arb. 5:65, *pl, 10,* 1933.

Shrubby twiners; stems striate with the bark of older stems verrucose-lenticellate, minutely puberulent to tomentose, rarely glabrous. Leaves petiolate, ovate, deltoid or suborbicular, entire to crenate, the apex obtuse or acute, mucronate or sometimes emarginate, the base cordate, subcordate or truncate, 10-18 cm. long,

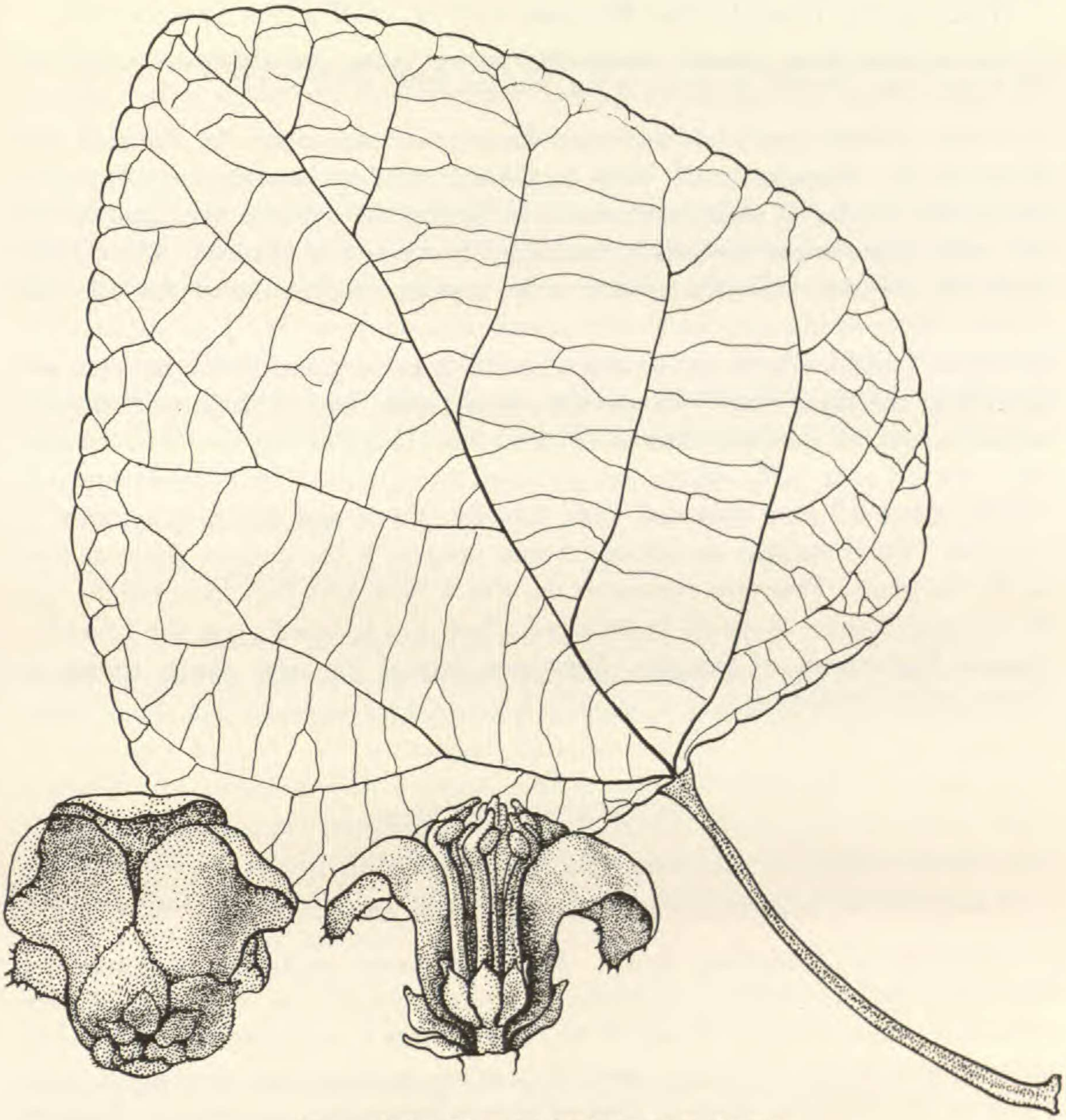

Figure 148. *Chondrodendron tomentosum*

9-18 cm. wide, at length subcoriaceous, 5-, 7- or 9-pli-nerved, glabrous above, white and woolly beneath; petioles distally and proximally swollen, 4-14 cm. long, puberulent to tomentose. Staminate inflorescence fasciculate in the leaf axils, paniculiform, 6 cm. or more in length, the rachis tomentose; bracts and bracteoles ovate, about 0.5 mm. long. Staminate flowers (in Panama): Sepals 9, 14, or 16, irregularly imbricate, the 3, 8, or 10 exterior small, broadly ovate, rounded or obtuse at the apex, 0.5-1.4 mm. long, 0.5-1.2 mm. wide, exteriorly tomentose or with the margins ciliolate, the 6 interior conspicuously larger, oblong-ovate, 2.5-3.0 mm. long, 1.5-1.7 mm. wide, glabrous or with the margins ciliolate; petals 6, minute, broadly ovate or lanceolate, acute or acuminate at the apex, 0.5-0.8 mm. long, 0.3-0.5 mm. wide, glabrous; stamens 6, 1.5 mm. long, inflexed, the connective produced beyond the thecae, the filaments free or coherent at the base. Pistillate flower or fruit not seen.

Peru, Bolivia, Colombia and Panama.

CANAL ZONE: Barro Colorado Island, shore east of Gross Trail, *Woodworth & Vestal 438*, Gatún Lake, altitude 120 meters or less, *Standley 40849, 41007, 41155.*

Three distinct types of staminate flowers are recognized by Krukoff and Moldenke (in Brittonia 3: 17. 1938) in *Chondrodendron tomentosum*. Type I is described as having 15 sepals with the outer 9 being 0.7-1.6 mm. long and 0.7-1.3 mm. wide, acute at the apex, fleshy, and slightly connate at the base. The 6 inner sepals are 3-4 mm. long, 1.7-2.5 mm. wide, campanulate-tubular at the base and glabrate except for the more or less fringed-ciliolate margins. The 6 petals are well-developed, broadly elliptic or obovate, about 0.5 mm. long and 0.25 mm. wide and rounded at the apex. The 6 stamens are about 2 mm. long. This is the *Botryopsis spruceana* type of staminate flower. Type II has (15-)19-22 sepals about 0.7 mm. long and 0.5 mm. wide which are glabrous throughout. The 6 petals are very minute, about 0.2 mm. long and wide, broadly elliptic and obtuse or rounded at the apex. The 6 stamens are about 1.2 mm. long with the anthers about as long as the filaments. This type represents the true *Chondrodendron tomentosum* type of staminate flower. Type III is described above and is based upon the *Chondrodendron hypoleucum* of Standley. Representatives of the three groups cannot be distinguished vegetatively.

2. ODONTOCARYA Miers.

ODONTOCARYA Miers, in Ann. Nat. Hist. ser. 2. 7: 38. 1851.

Chondodendron acc. to Benth. & Hook. f. Gen. 1:34. 1862, not Ruiz & Pav.

Twining or scrambling shrubs. Leaves alternate, petiolate. Staminate inflorescence axillary, solitary, racemiform, rarely paniculiform. Staminate flowers 3-merous, actinomorphic: Sepals 6-18, the exterior bracteoliform, the interior conspicuously larger, imbricate; petals 6, carnose, antesepalous; stamens 6, antepetalous, the filaments more or less coherent, dehiscence longitudinal. Pistillate inflorescence axillary, solitary, racemose. Pistillate flowers: Sepals and petals similar to the staminate; staminodia 6 or wanting; carpels 1-3, gibbose-oblong, the stigma sessile, 3-lobed. Fruit an ovoid-ellipsoidal drupe.

About 10 species. Lesser Antilles, Central America and South America.

a. Leaves lustrous; staminate inflorescences borne on short congested secondary branches; sepals 18; petals 0.6-0.7 mm. long, pubescent ..... 1. O. NITIDA

aa. Leaves dull; staminate inflorescences arising directly from main stem; sepals 6; petals 0.7 mm. or more in length, glabrous.

b. Leaves with glandular areas between the base of the midrib and lowest diverging nerves, the base usually cordate; staminate inflorescence racemiform; petals 1.5-2.6 mm. long ..... 2. O. PAUPERA

bb. Leaves not glandular, the base usually truncate; staminate inflorescence paniculiform; petals 0.7-1.2 mm. long ..... 3. O. TRUNCATA

1. ODONTOCARYA NITIDA Riley, in Kew Bull. 119. 1927.

Scrambling shrubs; stems striate, puberulent. Leaves petiolate, the lamina broadly ovate, entire, the apex obtusely caudate-acuminate, the base cordate, 5-11 cm. long, 3-6 cm. wide, subcoriaceous, glabrous above, dark and lustrous, palmately 5- to 7-nerved, puberulent below; petioles 2-4 cm. long, pubescent. Staminate inflorescence a racemiform thyrse, axillary, borne on a short congested leafy secondary branch, 3-6 cm. long, the rachis pubescent; bracts linear, about 1 mm. long. densely pubescent; bracteoles linear, 0.5 mm. long, densely pubescent. Staminate flowers: Sepals 18, ovate to elliptic, 0.8-2.1 mm. long, 0.5-1.2 mm. wide, carnose, the exterior densely pubescent; petals 6, obovate, the apex truncate or rounded, 0.6-0.7 mm. long, 0.3-0.5 mm. wide, carnose, the exterior densely pubescent; stamens 6, 0.7-0.8 mm. long, glabrous, the filaments coherent at the base. Pistillate flower and fruit not seen.

Endemic to Panama.

CANAL ZONE: Cocoli, *Riley 136.*

Riley recognizes no calyx or corolla and refers to the perianth as being comprised of tepals. The six innermost perianth segments, however, are conspicuously small and interrupt a transitional increase in size from the outermost whorl of segments inward. An anatomical distinction exists in that the six innermost segments are provided with a single median nerve characteristic of petals while the outer segments are provided with a single median plus a pair of lateral nerves characteristic of sepals. Bearing in mind the anatomical evidence present and the fact that the family is characterized by the presence of comparatively small petals, I consider the perianth to be dichlamydeous.

2. ODONTOCARYA PAUPERA (Griseb.) Diels, in Engl. Pflanzenr. 4.94: 172. 1910.

Chondodendron hederaefolium Miers, in Ann. Nat. Hist. ser. 2. 7:38. 1851, nom. nud.
Cocculus pauper Griseb. in Gotting. Abh. 7:162. 1857.
Chondodendron tomentosum Benth. in Journ. Linn. Soc. 5: suppl. 2. 47. 1861.
Odontocarya hederaefolia Miers, in Contrib. Bot. 3. 64. 1871.
Odontocarya scabra Miers, loc. cit. 65. 1871.

Climbing or scrambling shrubs; older stems thick and fleshy, conspicuously lenticellate, the younger stems striate, glabrous or essentially so. Leaves petiolate, the lamina broadly ovate to subhastate, entire, the apex acute or obtuse, mucronate, the base cordate or rarely obscurely truncate, 4.5-9.5 cm. long, 3.0-6.0 cm. wide, membranous, pubescent or puberulent above with conspicuous glandular areas between the base of the midrib and lowest diverging nerves, pubescent below; petiole 2.0-8.0 cm. long, pubescent or puberulent. Staminate inflorescence axillary, racemiform, about 7 cm. long, the rachis puberulent; bracts and bracteoles about 1.0-1.5 mm. long. Staminate flowers: Sepals 6, the 3 exterior ovate or elliptic, sparsely toothed, 1.2-2.0 mm. long, 0.6-1.0 mm. wide, membranous, essentially glabrous, the 3 interior conspicuously larger, obovate, the apex obtuse or rounded, 1.8-3.5 mm. long, 1.5-2.2 mm. wide, glabrous; petals 6, elliptic, carnose, 1.5-2.6 mm.

Figure 149. *Odontocarya paupera*

long, 1.0-1.8 mm. wide, glabrous; stamens 6, 1.0-1.8 mm. long, the filaments more or less coherent. Pistillate inflorescence an axillary raceme, about 9 cm. long, the rachis puberulent; bracts and bracteoles about 1.0 mm. long. Pistillate flowers: Sepals and petals similar to the staminate; carpels 1-3, gibbose, free, sessile, the style not evident, the stigma 3-lobed. Drupe ovoid, about 1 cm. long, 0.5 cm. wide; endocarp semi-ellipsoid, verrucose, ribbed.

Panama, Lesser Antilles and northern South America.

CANAL ZONE: Balboa, moist thicket, *Standley 27130;* in Powell Garden, *Standley 41189;* vicinity of Miraflores, *G. White 121;* locality omitted, *Johansen 70.* PANAMÁ: Isla Taboga, ca. 0-186 m., *Woodson, Allen & Seibert 1486;* Las Sabanas, wet thicket, *Standley 40778, Paul 599;* San José Island, Perlas Archipelago, *Erlanson 581, 546, Johnston 7, 786.*

There has been considerable taxonomic confusion and misdetermination between this species and *Odontocarya nitida.* The two species are readily distinguished, however, as *Odontocarya paupera* possesses distinctive glandular areas on the leaf, an essentially glabrous flower with six sepals, and staminate inflorescences which are borne upon the main stem of the vine. *Odontocarya nitida* has a leaf devoid of glandular areas, a pubescent flower with 18 sepals, and staminate inflorescences which are borne on short congested secondary branches.

3. ODONTOCARYA TRUNCATA Standl. in Journ. Arn. Arb. 11: 121. 1930.

Twining shrubs; stems striate, conspicuously verrucose-lenticellate, glabrous. Leaves petiolate, the lamina ovate, the apex acuminate, the base truncate or obscurely cordate, 7-12 cm. long, 5-9 cm. wide, at length subcoriaceous, glabrous, somewhat bullate above; petioles 3-4 cm. long, glabrous. Staminate inflorescence axillary, paniculiform, 8-24 cm. long, the rachis glabrous; bracts 1.0-1.5 mm. long, 0.5 mm. wide; bracteoles scarious, ovate to lanceolate, 0.5-1.0 mm. long. Staminate flowers: Sepals 6, glabrous, the 3 exterior obscurely coherent at the base, ovate to lanceolate, membranous, 0.5-0.8 mm. long, 0.3-0.6 mm. wide, the 3 interior conspicuously larger, ovate to elliptic, the apex obtuse or rounded, the base truncate or rounded, 1.3-1.7 mm. long, 1.0-1.4 mm. wide; petals 6, cuneate, carnose, 0.7-1.2 mm. long, 0.5-0.8 mm. wide, glabrous; stamens 6, about 1 mm. long, the filaments coherent at the base. Pistillate flower not seen. Drupe ovoid, yellow about 1.5 cm. long, 1.0 cm. wide.

Endemic to Panama.

CANAL ZONE: Barro Colorado Island, *Bangham 541, Salvoza 960;* Las Cascadas Plantation, near Summit, *Standley 29519;* Margarita Swamp, south of France Field, *Maxon & Valentine 7046.*

3. ANOMOSPERMUM Miers.

ANOMOSPERMUM Miers, in Ann. Nat. Hist. ser. 2. 7: 39. 1851.

Woody climbers. Leaves alternate, petiolate. Staminate inflorescence axillary, solitary or fasciculate, racemiform or paniculiform. Staminate flowers 3-merous, actinomorphic: Sepals 6, the exterior bracteoliform, the interior conspicuously larger, imbricate; petals 6, so greatly involute as to almost conceal the stamens

by forming a "pseudodisc"; stamens 6, free, dehiscence longitudinal. Pistillate inflorescence axillary, racemose or sessile and umbelliform. Pistillate flowers: Sepals and petals similar to the staminate; staminodia 6; carpels 3, free; stigma subsessile or sessile, lingulate. Drupes 1-3, excentrically stipitate, erect or curved; albumen copious, ruminate.

About 11 species. South America and Panama.

The only representative of this genus thus far collected in Panama (COCLÉ, El Valle de Antón, *Allen* 3538) is perhaps a new species but the absence of flowering material prevents an adequate analysis at this time. This specimen is closely related to *Anomospermum reticulatum* (Mart.) Eichl. of the Amazon basin in that the extremely dense venation reticulum of the lamina is as conspicuous beneath as above, but differs in the glabrous petioles and the absence of any pubescence on the lower leaf surface.

4. HYPERBAENA Miers.

HYPERBAENA Miers, in Ann. Nat. Hist. ser. 2. 7: 44. 1851.

Pachygone Eichl. in Denkschrift. Bot. Gesellsch. Regensb. 5:1. 1864.

Woody twiners or sometimes erect shrubs or small trees. Leaves alternate, petiolate. Staminate inflorescence axillary, fasciculate, spiciform or racemiform. Staminate flowers 3-merous, actinomorphic: Sepals 6, the exterior bracteoliform, the interior conspicuously larger, imbricate; petals 6, antesepalous; stamens 6, antepetalous, free or the filaments connate at the base, dehiscence longitudinal. Pistillate inflorescence axillary, solitary, racemose. Pistillate flowers: Sepals and petals similar to the staminate; staminodia 6; carpels 3, free, gibbose; style reflexed. Drupes sessile, curved; exalbuminous.

About 40 species. Mexico, Central America, South America and the Antilles.

a. Woody twiners; leaves palmately 5-nerved; inner sepals 2.5-4.0 mm. long, densely pubescent; petals pubescent; stamens cucullate, pubescent .....1. H. PANAMENSIS

aa. Small trees; leaves pinnately nerved; inner sepals 1.1-1.4 mm. long, glabrous or essentially so; petals glabrous; stamens erect, glabrous .....2. H. ALLENII

1. HYPERBAENA PANAMENSIS Standl. in Journ. Wash. Acad. Sci. 15: 474. 1925.

Hyperbaena hondurensis Standl. in Field Mus. Pub. Bot. 4:305. 1929.

Woody vines; stem striate with the bark of older stems conspicuously lenticellate, puberulent or glabrous. Leaves petiolate, elliptic, ovate or oblong, entire, the apex abruptly acute, acuminate or obtuse, mucronate, the base obtuse, rounded or truncate, 6-24 cm. long, 3-14 cm. wide, at length coriaceous, palmately 5-nerved, frequently with a pinnate aspect, the basal nerves frequently slender and inconspicuous, glabrous above, sparsely and minutely puberulent or glabrous below; petioles swollen distally, 1-9 cm. long, glabrous to puberulent. Staminate inflorescence fasciculate or solitary in the leaf axils, racemiform, up to 20 cm. in length, the rachis pubescent to tomentose; bracts and bracteoles ovate to linear, about 1 mm. long, densely pubescent. Staminate flowers: Sepals 6, the 3 outermost small, ovate, 0.7-1.2 mm. long, 0.5-0.8 mm. wide, exteriorly pubescent, the 3

innermost conspicuously larger, broadly ovate, 2.5-4.0 mm. long, 2.2-2.5 mm. wide, exteriorly pubescent; petals 6, minute, spatulate to oblong, about 0.5 mm. long, exteriorly pubescent; stamens 6, cucullate, about 1.3 mm. long, densely pubescent, the anthers immersed within the connective, the filaments free or rarely coherent at the base. Pistillate inflorescence solitary or fasciculate in the leaf axils, racemose, about 8 cm. long, the rachis tomentose; bracts and bracteoles ovate to linear, about 0.5-1.0 mm. long, densely pubescent. Pistillate flowers: Sepals and petals similar to the staminate; staminodia 6, about 2.5 mm. long, pubescent at the base; carpels 3, gibbose, sessile, the style not evident, the stigma radiate-incised. Drupe obovoid, 1.5-2.5 cm. long, puberulent or glabrous.

Panama, Costa Rica, Guatemala, Honduras and British Honduras.

CANAL ZONE: Barro Colorado Island, *Bangham 484, Bailey 101, Standley 40978, 40800, 40787, 41077, Wetmore & Woodworth 76;* Gamboa, *Standley 28417.*

Considerable deliberation involved the placing of *Hyperbaena hondurensis* into synonomy. In 1925 Standley described *Hyperbaena panamensis* (*Standley 28417*) from sterile material. The distinguishing characteristic was the venation. A palmately 5-nerved condition provided a pair of slender and inconspicuous basal nerves, a prominent midrib, and a prominent pair of inner nerves extending almost to the apex of the leaf so as to impart a subparallel effect.

In 1929 Standley described *Hyperbaena hondurensis* (*Standley 55220*), once again from sterile material. A palmately 5-nerved condition existed here also but the inner pair of nerves extended approximately half the length of the leaf and several lateral nerves originated from the midrib. This afforded a pinnate aspect to the leaf.

Specimens from Panama and Costa Rica illustrate the *Hyperbaena panamensis* type of venation while those of Honduras, Guatemala and British Honduras the *H. hondurensis* type. Unfortunately, no specimens from Nicaragua are available. The *Hyperbaena panamensis* type of leaf is provided with somewhat more pubescence on the lower surface and has a somewhat shorter petiole than the *Hyperbaena hondurensis* type.

Vegetatively, it appears that two species exist. However, floral examination involving the two types indicates the opposite view as no floral distinction can be formulated between the two. Furthermore, the pubescent petals, cucullate stamens, and connivent carpels present very distinctive floral characteristics thereby making their appearance in separate species quite unlikely. Along this line of thought is the marked contrast between the floral characteristics noted above and allied species of the genus, for example, *Hyperbaena allenii.*

In summary it can be stated that although considerable variation exists vegetatively, the floral similarity between *Hyperbaena panamensis* and *H. hondurensis* unite them as one species—*H. panamensis* by precedence.

2. HYPERBAENA ALLENII Standl. in Ann. Missouri Bot. Gard. 27:310. 1940.

Small trees; young stems striate, densely pubescent. Leaves petiolate, lanceolate-oblong, entire, the apex acute or obtuse, the base obtuse or rounded, 14-23 cm.

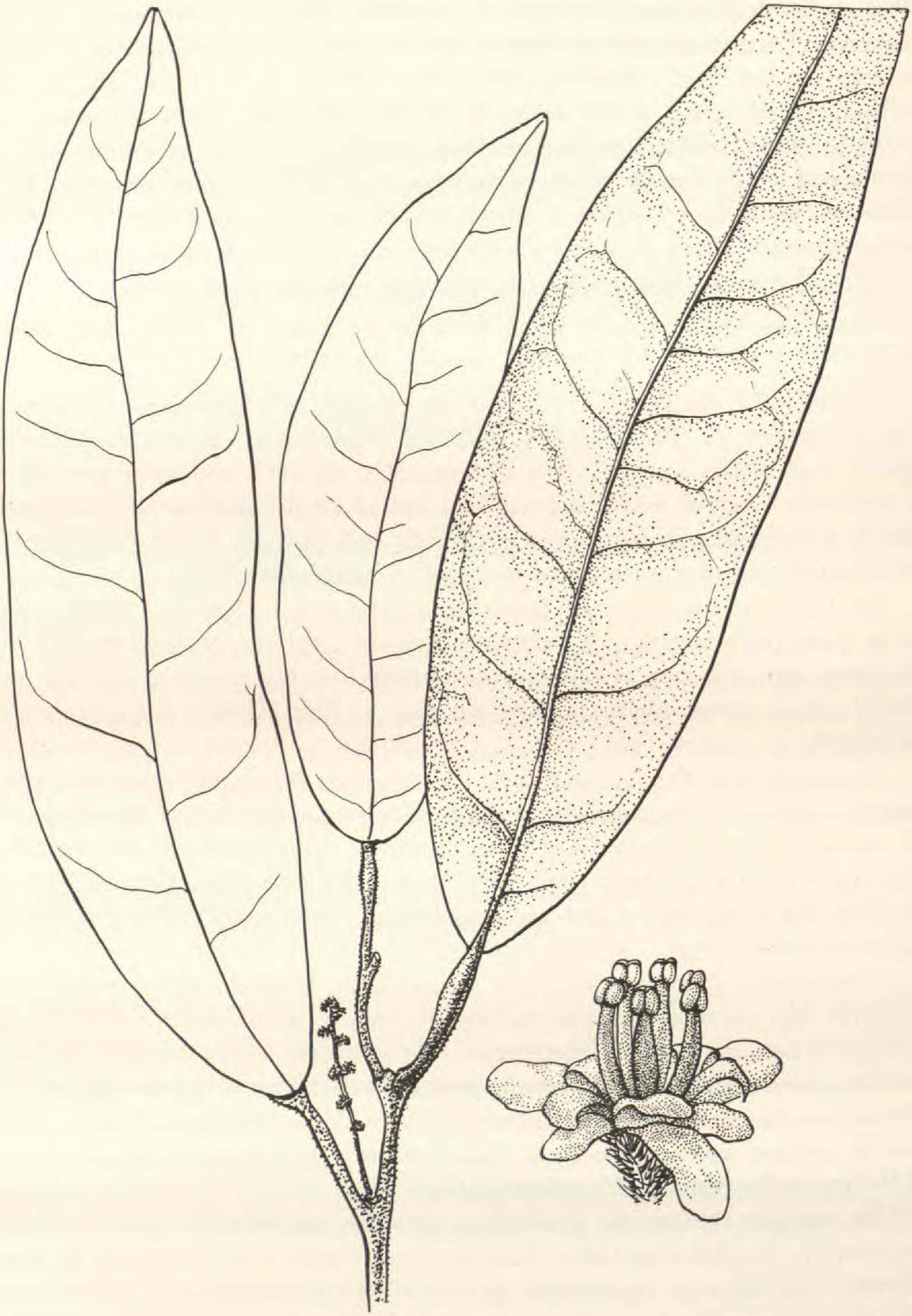

Figure 150. *Hyperbaena allenii*

long, 4.5-6.0 cm. wide, subcoriaceous, pinnately nerved, glabrous above, puberulent below; petioles swollen distally, 1.5-3.0 cm. long, densely pubescent. Staminate inflorescence axillary, fasciculate, spiciform, 0.5-3.0 cm. long, the rachis densely pubescent; bracts and bracteoles about 0.5 mm. long, densely pubescent. Staminate flowers; Sepals 6, the 3 outermost small, obovate, obscurely toothed, 0.7-0.9 mm. long, 0.5-0.6 mm. wide, exteriorly pubescent, the 3 innermost conspicuously larger, obovate, obscurely toothed, 1.1-1.4 mm. long, 0.7-0.9 mm. wide, glabrous or with the margins ciliolate; petals 6, obovate, 0.5-0.8 mm. long, 0.3-0.5 mm. wide, glabrous; stamens 6, free, about 1 mm. long, glabrous. Pistillate flower not seen. Fruit ovoid, about 2 cm. long, glabrous.

Endemic to Panama.

COCLÉ: north rim of El Valle de Antón, 600-1000 m., *Allen 1656;* north of El Valle de Antón, trail to Las Minas, alt. about 1000 m., *Allen 2465;* Loma del Tigre, region north of El Valle de Antón, alt. 1000 m., *Allen 3807*.

5. CISSAMPELOS L.

CISSAMPELOS L. Sp. Pl. 1031. 1753.

Dissopetalum Miers, in Ann. Nat. Hist. ser. 3. 17:267. 1866.

Twining shrubs, rarely erect. Leaves alternate, petiolate, more or less peltate or basifixed. Staminate inflorescence axillary, generally fasciculate, normally originating in a leafy axil as multiflowered dichasia or the dichasia originating on axillary secondary branches in the axils of reduced leaves or bracts. Staminate flowers 2-merous, actinomorphic: Sepals 4, usually exteriorly pubescent; petals connately cupulate; stamens 4, the anthers sessile on a column formed by the connate filaments, dehiscence transverse. Pistillate flowers fasciculate in the axils of reduced leaves or bracts upon secondary, frequently fasciculate, axillary branches, zygomorphic: Sepal 1, obovate, exteriorly pubescent; petal 1, antesepalous; carpel 1, free, gibbose, the style short, the stigma 3-lobed. Drupes subglobose; endocarp osseous, verrucose, ribbed.

A troublesome genus of about 25 species. North and South America, Africa, Asia and Australia.

a. Leaves conspicuously peltate, the base usually truncate or rounded, indument when present sericeous with long whitish hairs; bracts of secondary axillary branches large and foliaceous; carpels essentially glabrous; drupes 5-7 mm. long ..... 1. C. TROPAEOLIFOLIA

aa. Leaves generally obscurely peltate or basifixed, the base cordate, rarely truncate or rounded, indument sericeous or tomentose with short reddish-yellow, yellowish-brown or whitish hairs; bracts of secondary axillary branches usually much reduced; carpels densely pubescent; drupes 2.5 mm. long.

b. Leaves puberulent above, pubescent below; staminate inflorescence commonly arising from the axils of bracts upon secondary, generally fasciculate, axillary branches; sepals of staminate and pistillate flowers with conspicuous red spotting; drupes 2-4 mm. long. ..... 2. C. FASCICULATA

bb. Leaves usually more or less pubescent above and below; staminate inflorescence commonly arising from normal leaves; sepals of staminate and pistillate flowers without conspicuous red spotting; drupes 4-5 mm. long. ..... 3. C. PAREIRA

The frequent appearance of *Cissampelos grandifolia* Triana & Planch. in Costa Rican and Colombian collections suggests its probable presence in Panama. Although several specimens have been misdetermined as *Cissampelos grandifolia,* I do not find the species to have been collected in Panama. The species is distinguished by its much-branched and spreading paniculiform inflorescence and the large, conspicuously peltate, broadly ovate to suborbicular, long-petiolate leaves.

1. Cissampelos tropaeolifolia DC. Syst. 1:532. 1818.

Cissampelos membranacea Triana & Planch. in Ann. Sc. Nat. ser. 4. 17:43. 1862.

Subherbaceous twiners; stems striate, pubescent or puberulent, rarely glabrous. Leaves petiolate, conspicuously peltate, ovate to suborbicular, entire to crenate, the apex obtuse, rounded or acuminate, mucronate, the base truncate or rounded, rarely cordate, 5-11 cm. long, 5-10 cm. wide, membranous, palmately nerved, sericeous with long whitish hairs or glabrous above, paler and occasionally glaucous below, sericeous or puberulent; petioles 4-9 cm. long, tomentose to glabrous. Staminate inflorescence multiflowered fasciculate dichasia in the leaf axils or upon short secondary axillary branches within the axils of reduced leaves or bracts, the two forms frequently occurring together; bracts of secondary branches large and foliaceous, basifixed, sessile or obscurely petiolate, broadly cordate to subreniform, mucronate, 5-15 mm. long, 4-25 mm. wide, membranous, puberulent to densely pubescent; bracteoles linear, about 0.5 mm. long, pubescent. Staminate flowers: Sepals 4, ovate, oblong or obovate, 1.0-1.4 mm. long, 0.8-1.0 mm. wide, glabrous or exteriorly puberulent; corolla campanulate, 0.5-1.0 mm. in diameter, glabrous; anthers 4, glabrous. Pistillate inflorescence composed of individual flowers fasciculate in the axils of bracts upon secondary axillary branches. Bracts and bracteoles similar to the staminate. Pistillate flowers: Sepal 1, ovate to obovate, 1.0-1.2 mm. long, 0.8-1.0 mm. wide, glabrous or puberulent; petal 1, suborbicular, 0.5-0.7 mm. long, 0.5-1.0 mm. wide; carpel 1, gibbose, sessile, essentially glabrous, the stigma 3-lobed. Drupe red, obovoid, compressed, 5-7 mm. long, 4-5 mm. wide, pubescent, rarely glabrous; endocarp ribbed, verrucose.

Southern Mexico, Central America and northern South America.

bocas del toro: Chiriquí Lagoon, *Von Wedel 1853, 1119, 1376, 1372, 1035;* Isla Colón *Von Wedel 46, 2947;* Old Bank Island, *Von Wedel 2083, 1888, 1991, 1985;* Water Valley *Von Wedel 673, 1819, 1490;* Chiriquí Lagoon region, Punta Rovalo and Rovalo River, *Seibert 1563;* Columbus Island, *Von Wedel 23;* no locality given but presumably Chiriquí Lagoon or vicinity, *Von Wedel 381, 382, 382.* canal zone: Barro Colorado Island, *Standley 41002, Shattuck 430;* near mouth of R. Chagres, *Allen 897;* Gatún, *Stevens 1342;* Mount Hope Cemetery, *Standley 28789;* between Mount Hope and Santa Rita Trail, *Cowell 94.* colón: between France Field and Cativa1, *Standley 30345.* chiriquí: Río Chiriquí to Remedios, ca. 15-50 m., *Woodson, Allen & Seibert* 1187; between R. Tinta and R. Tabasará, along main highway, *Woodson, Allen & Seibert 414;* vicinity of San Félix, alt. 0 to 120 m., *Pittier 5458.* darién: Cana and vicinity, 2000-6500 ft. el., *Williams 778;* Paca below Cana, *Williams 767.*

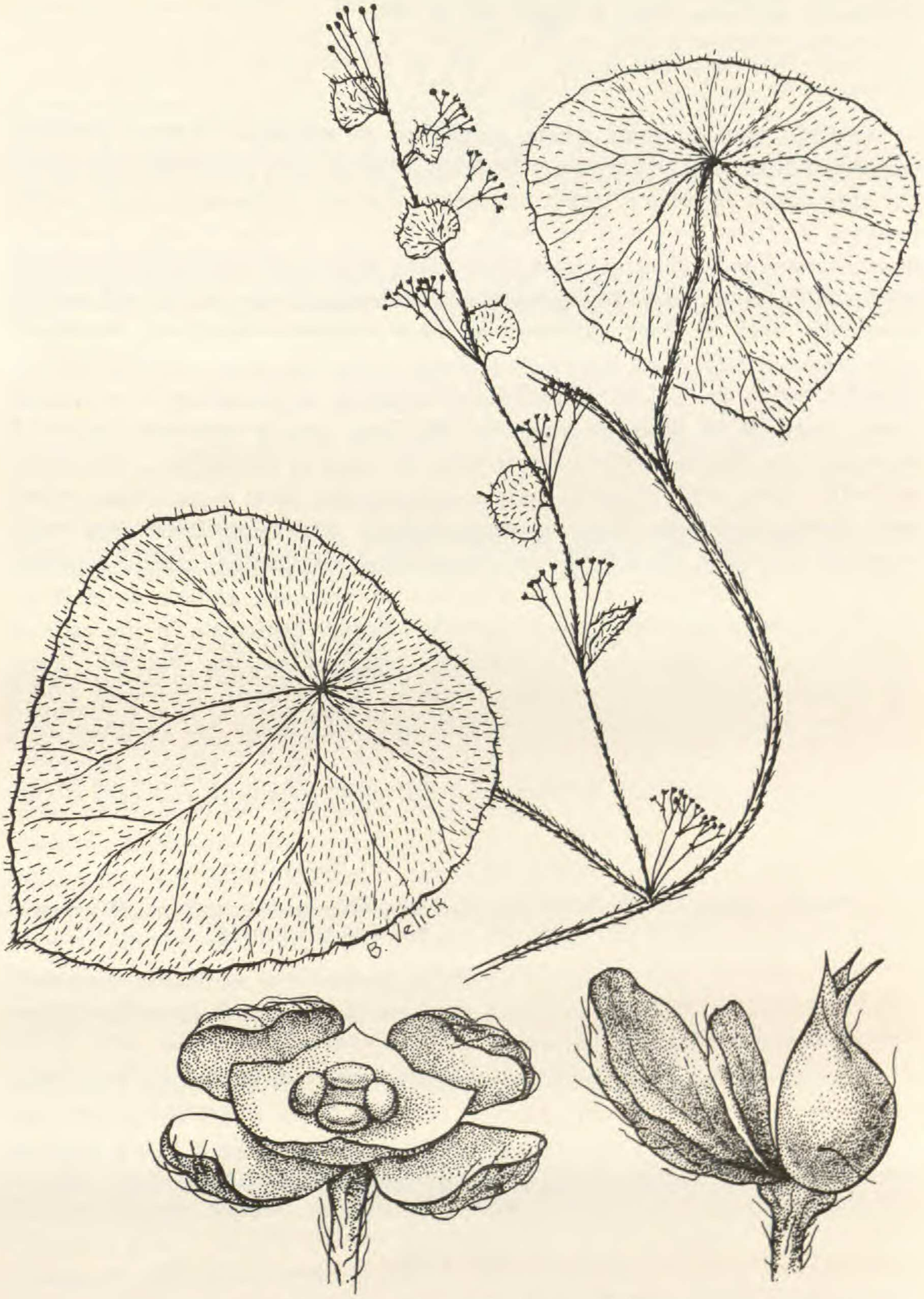

Figure 151. *Cissampelos tropaeolifolia*

2. Cissampelos fasciculata Benth. in Lond. Journ. Bot. 2:361. 1843.

Cissampelos scutigera Triana & Planch. in Ann. Sc. Nat. ser. 4. 17:42. 1862.
Cissampelos myriocarpa Triana & Planch., loc. cit. 1862.
Cissampelos andromorpha Eichl. in Mart. Fl. Bras. 13. 1:195. 1864.
Cissampelos floribunda Miers, in Ann. Nat. Hist. ser. 3. 17:135. 1866.
Cissampelos coriacea Standl. in Field Mus. Pub. Bot. 18:437. 1937.

Shrubby twiners; stems striate, puberulent to tomentose. Leaves petiolate, conspicuously or obscurely peltate or basifixed, broadly ovate to suborbicular, entire, the apex obtuse, rounded or acute, mucronate, the base cordate or truncate, rarely rounded, 4-14 cm. long, 5-15 cm. wide, membranous to subcoriaceous, palmately 5- to 9-nerved, puberulent and dark above, paler below and sericeous or tomentose with reddish-yellow, yellowish-brown or whitish hairs; petioles twisted and swollen proximally, 4-11 cm. long, pubescent or more commonly tomentose. Staminate inflorescence multiflowered fasciculate dichasia originating upon secondary axillary branches within the axils of reduced leaves or bracts, rarely axillary from normal leaves; peduncle of cymes at length 1.5 cm. long, densely pubescent; bracts of secondary branches basifixed, sessile or petiolate, ovate to subreniform, mucronate, generally conspicuously involute, pubescent; bracteoles about 1 mm. long, pubescent. Staminate flowers: Sepals 4, obovate, 0.8-1.5 mm. long, 0.5-0.8 mm. wide, exteriorly pubescent, the interior with conspicuous red spotting; corolla cupulate, 0.6-1.0 mm. in diameter, sparsely pubescent or glabrous; anthers 4, glabrous. Pistillate inflorescence composed of individual flowers fasciculate in the axils of bracts upon fasciculate secondary, frequently branched, axillary branches; bracts and bracteoles similar to the staminate. Pistillate flowers: Sepal 1, obovate, 1.0-2.0 mm. long, exteriorly pubescent, the interior with conspicuous red spotting; petal 1, suborbicular, 0.5-0.8 mm. long, 0.7-1.0 mm. wide; carpel 1, gibbose, pubescent. Drupe obovoid, compressed, 2-4 mm. long and wide, pubescent; endocarp ribbed, verrucose.

Nicaragua, Costa Rica, Panama and northern South America.

Chiriquí: vicinity of Bajo Mona and Quebrada Chiquero, alt. 1500 m., *Woodson & Schery* 545; vicinity of Bajo Chorro, alt. 1900 m., *Woodson & Schery* 682.

After extensive examination of available material no significant distinction could be ascertained between *Cissampelos coriacea* Standl. and *C. fasciculata*, therefore the former is placed in synonomy.

Vegetatively this species tends to be quite variable. Specimens from Costa Rica habitually bear large obscurely peltate or basifixed leaves which are broadly cordate. Panamanian and Colombian material, on the other hand, has a tendency toward smaller suborbicular leaves which are conspicuously peltate.

3. Cissampelos pareira L. Spec. Pl. 1031. 1753.

Cissampelos pareira α L., loc. cit. 1753.
Cissampelos caapeba L. loc. cit. 1032. 1753.
Cissampelos cocculus Poir. in Lam. Encycl. 5:9. 1804.
Cissampelos heterophylla DC. Syst. 1:534. 1818.
Cissampelos microcarpa DC. loc. cit. 1818.

Cissampelos discolor DC. loc. cit. 1818.
Cissampelos tomentosa DC. loc. cit. 1818.
Cissampelos tamoides Willd. ex DC. loc. cit. 536. 1818.
Cissampelos argentea H.B.K. Nov. Gen. & Sp. 5:67. 1821.
Cissampelos guayaquilensis H.B.K. loc. cit. 1821.
Cissampelos orinocensis H.B.K. loc. cit. 68. 1821.
Cissampelos monoica St. Hil. Fl. Bras. Mer. 1:55. 1825.
Cissampelos australis St. Hil. loc. cit. 56. 1825.
Cissampelos haenkeana Presl. Rel. Haenk. 2:80. 1836.
Cissampelos hirsutissima Presl. loc. cit. 1836.
Cissampelos kohautiana Presl. loc. cit. 81. 1836.
Cissampelos acuminata Benth. Pl. Hartw. 445. 1839, not DC.
Cissampelos canescens Miq. Sert. Exot. 7. *t. 4* 1842.
Cissampelos glaucescens Triana & Planch. in Ann. Sc. Nat. ser. 4. 17:41. 1862.
Cissampelos subreniformis Triana & Planch. loc. cit. 1862.
Cissampelos longipes Miers, in Ann. Nat. Hist. ser. 3. 17:134. 1866, nom. nud.; Contrib. Bot. 3:139. 1871.
Cissampelos testudinaria Miers, loc. cit. 1866, nom. nud.; loc. cit. 143. 1871.
Cissampelos limbata Miers, loc. cit. 1866, nom. nud.; loc. cit. 1871.
Cissampelos benthamiana Miers, loc. cit. 1866, nom. nud.; loc. cit. 144. 1871.
Cissampelos auriculata Miers, loc. cit. 135. 1866, nom. nud.; loc. cit. 158. 1871.
Cissampelos hederacea Miers, loc. cit. 1866, nom. nud.; loc. cit. 159. 1871.
Cissampelos consociata Miers, loc. cit. 1866, nom. nud.; loc. cit. 167. 1871.
Cissampelos diffusa Miers, loc. cit. 136. 1866, nom. nud.; loc. cit. 168. 1871.
Cissampelos pareira var. δ. *monoica* Eichl. in Mart. Fl. Bras. 131:190. 1894.
Cissampelos pareira f. *reinformis* and f. *emarginato-mucronata* Chod. & Hassl. in Bull. Herb. Boiss. ser. 2. 3:420. 1903.

Shrubby twiners; stems striate, glabrous to tomentose. Leaves petiolate, obscurely peltate or basifixed, broadly ovate, entire, the apex obtuse, rarely acuminate, frequently somewhat emarginate, mucronate, the base truncate or cordate, 2-12 cm. long and wide, membranous or papery, palmately 3- to 7-nerved, in youth more or less sericeous-tomentose on both sides, at length above more or less pubescent, rarely glabrous, below frequently paler, tomentose or pubescent, rarely entirely glabrous. Staminate inflorescence multiflowered fasciculate dichasia in the leaf axils, sometimes upon secondary axillary branches within the axils of reduced leaves or bracts; bracts of secondary branches basifixed, sessile or obscurely petiolate, ovate to subreniform, mucronate, about 1 cm. long and wide to minute, membranous, pubescent to tomentose; bracteoles linear, about 0.5 mm. long, pubescent. Staminate flowers: Sepals 4, ovate to obovate, exteriorly pubescent, 1.0-2.0 mm. long, 0.5-1.2 mm. wide; corolla campanulate, 0.8-1.8 mm. in diameter; anthers 4, glabrous. Pistillate inflorescence composed of individual flowers fasciculate upon secondary axillary branches within the axils of reduced leaves or bracts; bracts basifixed, sessile or obscurely petiolate, broadly ovate to reniform, mucronate, about 1.5 mm. long, 2.0 mm. wide to minute, membranous, puberulent to tomentose. Pistillate flowers: Sepal 1, obovate, 1.0-2.0 mm. long, 0.5-0.8 mm. wide, exteriorly pubescent; petal 1, broadly obovate to reniform, 0.5-0.8 mm. long, 0.7-1.5 mm. wide, glabrous or puberulent; carpel 1, gibbose, densely pubescent. Drupe broadly obovate or suborbicular, compressed, 4-5 mm. long, 3-4 mm. wide, pubescent or puberulent; endocarp verrucose, ribbed.

Southern Mexico, Central America, South America, Antilles, eastern Africa, India, Malaya, Indonesia, Philippines, northern Australia and Madagascar.

BOCAS DEL TORO: Chiriquí Lagoon, *Von Wedel 1309;* Shepherd Island, *Von Wedel 2691.* CANAL ZONE: Barro Colorado Island, *Aviles 921, 57, 888, Shattuck 476, Bailey & Bailey 575, Wetmore & Abbe 177, 178;* Bismark above Penonomé, *Williams 536;* Balboa, *Standley 25526;* Chagres, *Fendler 4;* Chivi-Chivi Trail, 2 miles above Red Tank, *Maxon & Harvey 6578;* Darién Station, *Standley 31642;* Empire to Mandinga, *Piper 5480;* Gatún, *Hayes 1035;* Juan Mina, *Piper 5688;* Las Cascadas Plantation, near Summit, *Standley 25672;* in government forest along Las Cruces Trail, 75 m., *Hunter & Allen 752;* Mamei Hill, alt. 20 to 90 m., *Pittier 3796;* Obispo, *Standley 31773;* Río Grande, near Culebra, alt. 50 to 100 m., *Pittier 2092;* Fort Kobbe road, *Woodson, Allen & Seibert 1425, 1426;* thickets north of Summit, *Woodson, Allen & Seibert 766;* vicinity of Miraflores, *P. White 120, G. White 122;* western slope of Ancón Hill, *Woodson, Allen & Seibert 1324;* around Culebra, alt 50 to 150 m., *Pittier 2218;* Old Experiment Station, 3 miles east of Panama City, *Maxon, Harvey & Valentine 7085.* CHIRIQUÍ: Boquete, *Davidson 611;* Cerro Vaca, eastern Chiriquí, in forest or in thickets, alt. 900 to 1136 m., *Pittier* 5323. COCLÉ: El Valle de Antón, alt. 600 m., *Allen 3705;* mountains beyond La Pintada, 400-600 m., *Hunter & Allen 581.* DARIÉN: locality missing, *Macbride 2699.* PANAMÁ: Bella Vista, *Bro. Heriberto 221;* vicinity of Bella Vista, *Piper 5370;* near Tapía River, Juan Díaz region, *Maxon & Harvey 6760;* Sabanas, *Bro. Paul 21, 40;* Sabanas near Chepo, 30 m., *Hunter & Allen 91.*

Diels divides *Cissampelos pareira* into nine varieties of which only two, var. α. *typica* and var. γ. *haenkeana,* occur in Panama. The former is characterized by having comparatively small, ovate, more or less peltate leaves which are pale below and more or less pubescent or tomentose above and below. This is the most common variety and is pantropic in distribution. The latter variety has similar characteristics but differs in having a larger leaf, 4-9 cm. long and wide, which is obscurely peltate and rarely ovate. To avoid possible taxonomic confusion the remaining varieties will not be discussed as they have little or no bearing on the Panamanian flora. The synonomy for *Cissampelos pareira* has been restricted to American varieties for similar reasons.

MAGNOLIACEAE

By J. E. DANDY

Trees or shrubs, glabrous or with an indumentum of simple hairs; wood heteroxylous; branches annulate at the nodes with the scars of fallen stipules. Leaves alternate, stipulate, petiolate, simple; stipules large, free from the petiole or adnate to it, at first enclosing the young growths, later deciduous and leaving an annular scar round the node; lamina penninerved, entire or rarely 2- or more-lobed. Flowers terminal or axillary, usually solitary, pedunculate, actinomorphic, hermaphrodite or rarely unisexual, entomophilous, usually large and fragrant; peduncle bearing 1 or more deciduous spathaceous bracts which at first enclose the flower-bud and after falling leave annular scars. Perianth 2- or more-cyclic, 3-6-merous; tepals 6 or more, free, imbricate, usually subequal and fleshy but the outer whorl sometimes reduced in size or texture so as to simulate a calyx. Androecium of numerous free stamens spirally arranged; filaments short or more or less elongated; anthers linear, 2-thecous, introrse to extrorse, dehiscing by longitudinal slits; connective often produced above the anther-thecae into an appendage. Gynoecium superior, sessile or stipitate; carpels numerous to few (rarely 1), spirally arranged, free or sometimes concrescent; ovules 2 or more, biseriate on the ventral suture. Fruit apocarpous or sometimes syncarpous; fruiting carpels dehiscing longitudinally or more rarely circumscissile or indehiscent, sometimes samaroid. Seeds 1 or more in each fruiting carpel, large, suspended (when carpel dehiscent) by a silky thread; testa arilloid or sometimes adherent to the endocarp; endosperm copious, oily; embryo minute.

Species about 220, mostly in southeast Asia, the others in tropical America and southeastern North America. The two tropical American genera, *Magnolia* and *Talauma*, belong to the tribe Magnolieae and are both more strongly represented in Asia than in America. Some species of the Asiatic genus *Michelia* L., notably *M. champaca* L. and *M. figo* (Lour.) Spreng., are widely planted in the tropics; this genus is distinguished from *Magnolia* and *Talauma* by its axillary flowers with a stipitate gynoecium.

a. Carpels free, longitudinally dehiscent in fruit, the valves persistent; stipules free from the petiole, the latter therefore unscarred ..... 1. MAGNOLIA

aa. Carpels concrescent at least towards the base, woody and circumscissile in fruit, the upper portions falling away, the lower portions persistent and bearing the suspended seeds; stipules adnate to the petiole, leaving a scar on its upper surface ..... 2. TALAUMA

1. MAGNOLIA L.

MAGNOLIA L. Sp. Pl. 1: 535. 1753.

Evergreen or deciduous trees or shrubs. Stipules free from or adnate to the petiole. Flowers terminal, hermaphrodite, at first enclosed in 1 or more spathaceous bracts. Gynoecium sessile or shortly stipitate; carpels numerous or few, free; ovules 2, rarely 3-4 in the lower carpels. Fruiting carpels dehiscing longitudinally, the valves persistent.

Species about 80, the majority in southeast Asia, the others in tropical America and southeastern North America. The Panama species belongs to Sect. Theorhodon Spach, an American section which extends from the southeastern United States to the Greater Antilles and through Mexico and Central America to northern South America. This section differs from the other American sections in its free stipules. It includes *M. grandiflora* L., native of the southeastern United States, which is widely planted in the tropics. Many other species of *Magnolia* are cultivated in temperate gardens.

1. Magnolia sororum Seibert, in Ann. Missouri Bot. Gard. 25: 828. 1938.

Tree up to 30 m. tall; indumentum rufous or tawny; branchlets densely villous-pubescent when young. Leaf-lamina elliptic or ovate-elliptic to elliptic- or ovate-oblong, cuneate to obtuse or rounded at the base, obtuse to subacute or subacuminate at the apex, up to about 20 cm. long and 10 cm. broad, coriaceous, at first pubescent above on the midrib towards the base, densely pubescent beneath; lateral nerves about 10-14 on each side of the midrib; petiole up to about 3 cm. long, at first densely villous-pubescent, sometimes glabrescent; stipules villous-pubescent outside. Flowers very fragrant; bud ellipsoid; bracts 1-4, the uppermost or single one inserted immediately below the flower, densely villous-pubescent outside; peduncle stout, about 1.5-4 cm. long, densely villous-pubescent. Tepals 9, 3-merous, white; outer 3 obovate-oblong, about 4-7 cm. long, sparingly pubescent outside at the very base; inner 6 up to about 8 cm. long, glabrous. Stamens about 13-15 mm. long. Gynoecium ellipsoid; carpels about 20-45, densely villous-pubescent. Fruit ellipsoid to ellipsoid-oblong, about 4.5-6 cm. long; fruiting carpels shortly beaked.

Endemic to the mountains of western Panama, at 1100-2500 m. altitude. Hess reports the vernacular name *vaco* in Chiriquí.

Chiriquí: valley of the upper Rio Chiriquí Viejo, alt. 1300-1900 m., *White & White 21, 239;* vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., *Woodson, Allen & Seibert 916;* vicinity of Casita Alta, north forested face of Cerro Copete, an eastern spur of Volcán de Chiriquí, alt. 2400-2550 m., *Allen 4874;* vicinity of Finca Lérida, alt. 1650 m. *Allen 4729;* Chiriquí, *Hess 261, 263.* Coclé: El Valle de Antón, crest of Cerro Pajita, alt. 1100 m., *Allen 3752.*

The handsome rufous or tawny indumentum readily distinguishes this species from the related *M. poasana* (Pittier) Dandy, which occurs to the west in Costa Rica.

2. TALAUMA Juss.

Talauma Juss. Gen. Pl. 281. 1789.

Svenhedinia Urb. in Fedde, Rep. Sp. Nov. 24: 3. 1927.

Evergreen trees or shrubs. Stipules adnate to the petiole. Flowers terminal, hermaphrodite, at first enclosed in 1 or more (usually several) spathaceous bracts. Gynoecium sessile; carpels numerous or few, concrescent at least towards the base; ovules 2. Fruiting carpels woody, circumscissile, the upper portions falling away

Figure 152. *Magnolia sororum*

either separately or in irregular masses, the lower portions persistent and bearing the suspended seeds.

Species about 45, mostly in tropical and subtropical southeast Asia, the others in tropical America in the Lesser Antilles, Cuba, southern Mexico and through Central America to Brazil. The genus is essentially tropical and lacks the strong North Temperate element present in *Magnolia*.

a. *Leaves rounded to obtuse at the apex, rather laxly reticulate* .....1. T. GLORIENSIS
aa. Leaves bluntly acuminate to subacute or apiculate at the apex, closely reticulate
2. T. SAMBUENSIS

1. TALAUMA GLORIENSIS Pittier, in Contrib. U.S. Nat. Herb. 13: 94. 1910
Magnolia allenii Standl. in Field Mus. Publ. Bot. 22: 331. 1940.

Tree up to 30 m. tall; branchlets glabrous. Leaf lamina ovate to ovate-elliptic or elliptic-oblong (occasionally obovate), cuneate to obtuse at the base, rounded to obtuse at the apex and sometimes slightly emarginate, up to about 31 cm. long and 16 cm. broad, coriaceous, glabrous; lateral nerves about 10-14 on each side of the midrib; petiole up about 5 cm. long, glabrous; stipules glabrous. Flower bud ovoid; bracts and peduncle glabrous. Tepals 9, 3-merous, greenish-white or creamy-white, glabrous; outer 3 oblong to oblong-elliptic, about 4-4.5 cm. long. Stamens about 13-15 mm. long. Gynoecium ovoid; carpels about 25-36, puberulous. Fruit ovoid; fruiting carpels up to about 4 cm. long, often becoming bifid at the apex.

Mountains of Costa Rica and western Panama, at about 1000 m. altitude. According to Pittier this species serves as a shade tree in the coffee plantations at La Gloria in the Cartago Province of Costa Rica.

COCLÉ: hills north of El Valle de Antón, alt. 1000 m., *Allen 2200, 3574.*

The Panama plant was described by Standley as a new species of *Magnolia, M. allenii;* his description was inaccurate in its reference to free stipules, connate bracts and glabrous carpels.

2. TALAUMA SAMBUENSIS Pittier, in Contrib. U.S. Nat. Herb. 20: 105. 1918.

Tree up to 40 m. tall; branchlets glabrous. Leaf lamina obovate- to elliptic- or ovate-oblong, cuneate to obtuse at the base, bluntly acuminate to subacute or apiculate at the apex, up to about 27 cm. long and 12.5 cm. broad, coriaceous or thinly coriaceous, glabrous; lateral nerves about 10-14 on each side of the midrib; petiole sometimes up to about 6 cm. long, glabrous; stipules glabrous. Flower-bud ovoid; bracts and peduncle glabrous. Tepals white. Fruit (according to Pittier) subglobose, about 8 cm. long and 7.5 cm. broad.

Endemic to southeastern Panama, at low altitudes up to 240 m.

DARIÉN: Río Cuasi, Chepigana District, alt. 240 m., *Terry & Terry 1420;* Boca de Pauarandó, on Río Sambú, alt. 20 m., *Pittier 5681.*

The available material of this species is too scanty for its characters to be fully described and understood. Its leaves are somewhat differently shaped at the apex and more closely reticulate than in *T. gloriensis,* which occurs further to the west and at a higher altitude.

WINTERACEAE

By J. E. DANDY

Trees or shrubs with homoxylous wood. Leaves alternate or sometimes subopposite or verticillate, exstipulate, simple; lamina penninerved, entire. Flowers terminal or axillary, solitary or in fascicles or simple or compound umbels, actinomorphic, hermaphrodite or unisexual. Perianth heterochlamydeous; calyx either closed round the bud and at length splitting into 2-3 lobes, or open and not enclosing the bud; petals 2-numerous (sometimes reduced to 1 or 0), free, imbricate. Stamens numerous or few, free, in 2 or more series; filaments more or less elongated; anthers small, 2-thecous, extrorse, dehiscing by longitudinal slits, the thecae parallel or convergent. Gynoecium superior, sessile or stipitate; carpels numerous or few (sometimes 1), in 1 or more series, free or sometimes concrescent; ovules several or numerous. Fruit apocarpous of 1 or more baccate carpels, or sometimes a syncarpous berry. Seeds with copious endosperm and a minute embryo.

An austral family of about 90 species, of which 4 are distributed in Central and South America, the remainder in the region of eastern Malaysia, the Solomon Islands, New Caledonia, Australia and New Zealand. The American species belong to the genus *Drimys* which is much more strongly represented in Malaysia and Australia.

1. DRIMYS J. R. & G. Forst.

Drimys J. R. & G. Forst. Charact. Gen. Pl. 83. 1776.

Wintera Murr. Syst. Veg. ed. 14, 507. 1784.

Trees or shrubs, sometimes epiphytic. Leaves alternate. Flowers hermaphrodite or unisexual, solitary, fasciculate or umbellate. Calyx at first completely closed round the bud, at length splitting into 2-3 often caducous lobes; petals 2 or more, sometimes reduced to 1 or 0. Carpels 1 or more, in 1 series, free; ovules 2-seriate on the ventral suture. Fruit apocarpous of 1 or more baccate carpels.

Species about 40, 4 in Central and South America, the others distributed in eastern Australia and in Malaysia from the Philippines and Borneo to New Guinea. The biggest concentration of species is in New Guinea.

1. Drimys granadensis L. f. Suppl. Pl. 269. 1781.

Wintera granadensis (L. f.) Murr. Syst. Veg. ed. 14, 507. 1784.

Shrub or small tree up to about 13 m. tall, glabrous. Leaf-lamina elliptic-oblong or narrowly elliptic-oblong to oblanceolate, cuneate or attenuate at the base, obtuse to rounded at the apex, up to about 17.5 cm. long and 5.5 cm. broad, coriaceous or subcoriaceous, glaucous or pale beneath; petiole up to about 2.5 cm. long. Flowers umbellate or fasciculate or sometimes solitary, hermaphrodite. Calyx 4.5-12 mm. long; petals 8-25, oblong to elliptic- or ovate-oblong, 5-25 mm. long. Stamens about 25-65, in 2-5 series. Carpels 3-24; ovules 7-12.

Southern Mexico to western Venezuela and Peru. The species is divided by A. C. Smith into five geographical varieties, the Panama population being regarded as endemic and named *D. granadensis* var. *chiriquiensis* A. C. Smith, in Journ. Arnold Arb. 24: 25. 1943; this variety occurs in rain-forest at about 1800-2250 m. altitude.

CHIRIQUÍ: Bajo Chorro, Boquete District, alt. 1800 m., *Davidson* 328.

Figure 153. *Drimys granadensis*

ANNONACEAE

By R. E. FRIES

Trees and shrubs with alternate and exstipulate leaves, always quite entire at the margins. Flowers generally trimerous. Sepals 3, valvate or imbricate. Petals generally 6, in two series, valvate or imbricate, free or rarely connate at the base, mostly conspicuously longer than the sepals; the inner petals often smaller, sometimes rudimentary or even absent. Stamens generally numerous; filaments short; anther cells adnate, the connective broad, usually expanded in a more or less truncate or hoodlike disc above the anther; the anther cells sometimes transversely septate by thin, horizontal membranes (anthers locellate). Carpels numerous, rarely few or solitary, generally free; ovules 1 or more. Fruiting carpels free (monocarps) or united in a dry or fleshy mass. Seeds with or without an aril, with copious ruminate endosperm; embryo minute.

This large family, which is of pantropic distribution, is represented in America by 36 genera. Two of them (*Annona* and *Xylopia*) occur also in Africa, two also in tropical Asia (*Artabotrys* and *Xylopia*). Only 14 genera and 41 indigenous species are recorded at present from Panama but there is no doubt that further investigations will show that more are to be found in the country.

Some species of *Annona* (in particular *muricata* L., *squamosa* L., *reticulata* L., and *Cherimolia* Mill.) are grown in the tropics for their edible fruits, and one or two of them are probably also cultivated in Panama. Only in respect to the last named, however, was any material from Panama available at the time when this was written. In the following, only the species known to grow wild in the Republic of Panama will be considered.

The Annonaceae of the Panama flora have been dealt with, *inter alia*, by Standley in his "Flora of the Panama Canal Zone" (in Contr. U.S. Nat. Herb. 27: 1-415. 1928) and "The Flora of Barro Colorado Island, Panama" (in Contr. Arnold Arboretum 5: 1-178. 1933). The first of these papers is very rich in valuable information on the native names of the species, for which readers are referred, as they are not quoted below.

a. Anthers not transversely septate.
  b. Petals not caudate-cuspidate.
    c. Flowers axillary.
      d. Petals imbricate.
        e. Connective of the stamens not expanded above the anther. ..... 2. Oxandra.
        ee. Connective expanded into a truncate disk above the anther.
          f. Ovule attached close to the upper end of the ovary and pendulous, sometimes located lower down, but not basal; pedicel nearly always with a small bract above the articulation ..... 1. Cremastosperma.
          ff. Ovule basal, erect; pedicel without a bract above the articulation ..... 3. Guatteria.

dd. Petals valvate.
e. Petals not keeled on the inner surface; ovules lateral, usually few to several, rarely solitary and, if so, attached near the lower or upper end of the ovary; monocarps irregularly bursting .....4. Unonopsis
ee. All petals, or only the inner, keeled on the inner surface above the middle; ovules 2, erect, basal; monocarps opening on the inside by a longitudinal split .....6. Anaxagorea.
cc. Flowers not axillary, more or less opposite the leaves.
d. Petals imbricate.
e. Pubescence of simple hairs; monocarps stipitate, free....9. Malmea.
ee. Pubescence of stellate hairs or stellate scales; monocarps sessile, often concrete .....12. Duguetia.
dd. Petals, at least the outer, valvate.
e. Monocarps free, stipitate .....7. Desmopsis.
ee. Monocarps sessile, united into a dry or fleshy mass.
f. Outer petals without wings or spurs .....13. Annona.
ff. Outer petals produced into wings or spurs .....14. Rollinia.
bb. Petals long caudate-cuspidate; ovules lateral .....8. Stenanona.

aa. Anthers transversely septate.
b. Pedicels with bracts .....5. Xylopia.
bb. Pedicels entirely without bracts.
c. Petals not saccate .....10. Porcelia.
cc. Inner petals large, saccate, with involute margins .....11. Cymbopetalum.

1. CREMASTOSPERMA R. E. Fries

Cremastosperma R. E. Fries, in Acta Hort. Berg. 10:46. 1930; 11: 323. 1931.

Shrubs or trees with 1, rarely 2, axillary flowers, or sometimes cauliflorous. Flowers medium-sized, generally glabrous; pedicels articulate above the base, nearly always with one small bract above the articulation. Sepals free, imbricate in bud, with thin, ciliolate margins. Petals much longer than the calyx, rigid, imbricate, with thin edges. Stamens numerous, the connective expanded above the anther into a disk. Carpels several; ovule 1, attached close to the upper end of the ovary and pendulous, or sometimes located lower down, even near the base and then erect. Monocarps free, stipitate, 1-seeded.

Seventeen species are known, inhabiting the most tropical parts of South America, from Panama and Colombia to Peru, Bolivia, Amazonian Brazil and French Guiana. Only one species is known from Panama.

Cremastosperma anomalum R. E. Fries, Svensk. Vet.-Akad. Handl. ser. 3, 24^{10}: 4, *pl. 1 c-d.* 1948.

Tree up to 10 m.; young branchlets glabrous, reddish. Leaves on petioles 5-8 mm. long, quite glabrous and lustrous on both sides, elliptic or oblong and broadest at the middle, rotundate at the base, abruptly cuspidate at the apex, (10-)15-28 cm. long and 5-10 cm. broad. Flowers solitary, white but blackening when dried; pedicels quite glabrous, 1-2 cm. long, articulate, without any bract above the articulation. Sepals glabrous, connate into a disk 8-10 mm. broad with ciliolate margin. Petals orbicular, 1.5 cm. diam., very shortly sericeous-tomentellous. Stamens

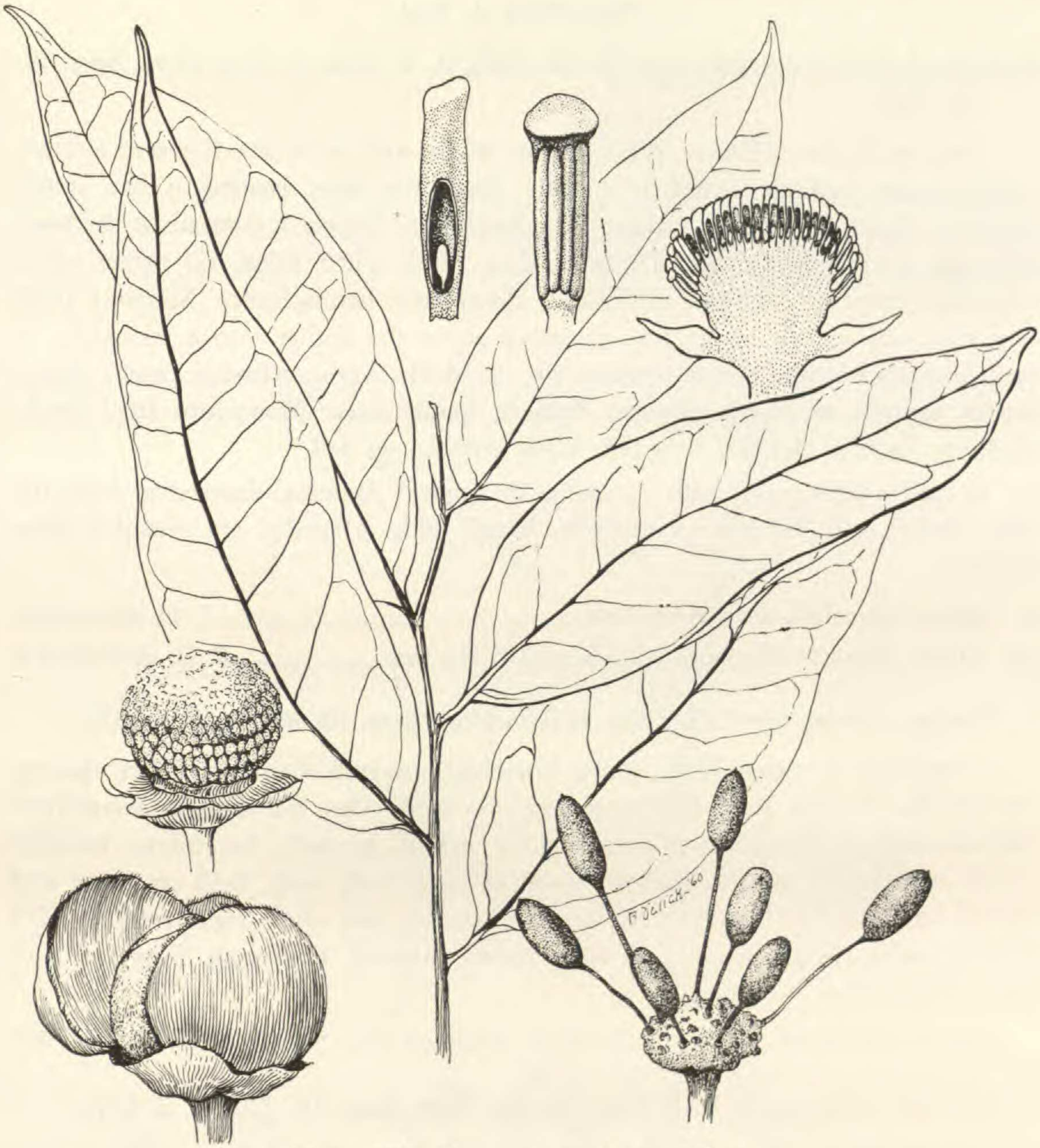

Figure 154. *Cremastosperma anomalum*

few, 2.0-2.5 mm. long. Carpels very numerous; ovule 1, attached near the base of the ovary, erect. Monocarps ellipsoid, 15-18 mm. long and 8 mm. across, black.

Panama and Colombia.

DARIÉN: vicinity of El Real, ca. 15 m. *Allen 969;* near the mouth of Río Yape, ca. 20 m., *Allen 348.*

2. OXANDRA A. Rich.

Oxandra A. Rich. in Sagra, Cub. 10: 45. 1845; R. E. Fries, in Acta Hort. Berg. 10: 153. 1931.

Trees or shrubs. Flowers small, solitary in the axils or in few-flowered axillary inflorescences; pedicels articulate a little above the base, bearing a few small, distichous bracts below and 1 above the articulation. Sepals 3, connate at the base, imbricate in bud, persistent. Petals 6, thin, black when dried, all rather alike, orbicular, ovate or oblong, imbricate. Receptacle hemispheric. Stamens 6-20, lanceolate-oblong, the connective elongated above the anther into a triangular to lanceolate appendage. Carpels rather few, (1-)4-13; ovaries cylindric-ovoid; stigma sessile, capitate or shortly clavate; ovule 1, basal, erect. Monocarps free, nearly sessile or shortly stipitate, 1-seeded. Seeds without an aril.

A rather large genus with 23 species in tropical America, distributed from the West Indies and Panama to southern Brazil; only 2 species are recorded from Panama.

a. Leaves lanceolate, acute at the base ..... 1. O. panamensis.

aa. Leaves elliptic or oblong-elliptic, rounded at the base ..... 2. O. longipetala.

1. Oxandra panamensis R. E. Fries, in Acta Hort. Berg. 10: 168, *fig.* 5, *c*, 1931.

Tree up to 6 meters high; young branchlets covered with crisp hairs. Leaves on petioles 3-5 mm. long, finally glabrous on both sides, but densely verruculose beneath and thinly appressed-hairy on the midrib beneath, lanceolate, broadest at the middle and equally narrowed and acute at both ends, 8-12 cm. long and 2.0-3.5 cm. broad. (Flowers unknown). Fruits on very short rigid pedicels (2-3 mm.); monocarps glabrous, black when dried, ellipsoid, 12-15 mm. long and 9-10 mm. across; stipes 1-1.5 mm. long.

darién: Marraganti and vicinity, 10-200 ft., *Williams 1017;* Boca de Cupe, *Williams 669.*

2. Oxandra longipetala R. E. Fries, in Acta Hort. Berg. 10: 170, *pl.* 5. 1931.

A small tree; young branchlets hirsute-tomentose. Petioles very short (about 1 mm. long). Leaves glabrous on the upper side, the midrib tomentellous when young, glabrous beneath and sparsely appressed-hairy on the midrib, elliptic or oblong-elliptic, rotundate and even subcordate at the base, rather long-acuminate at the obtuse apex, 7-10 cm. long and 2.5-3.5 cm. broad. Flowers solitary; pedicels 5-6 mm. long, appressed-hairy; flower buds oblong. Sepals rotundate-ovate. Petals linear-oblong, rotundate at the apex, up to 16 mm. long. Carpels about 11. (Fruit unknown).

canal zone: near Salamanca Hydrographic Station in the gorge of the R. Pequení, 70-80 m., *Dodge, Steyermark & Allen 16968;* Lion Hill Station, *Hayes*, 385.

Figure 155. *Oxandra longipetala*

3. GUATTERIA Ruiz & Pav.

Guatteria Ruiz & Pav. Fl. Peruv. & Chil. Prodr. 85, *tab. 17*. 1794; R. E. Fries, in Acta Hort. Berg. 12: 291. 1939.

Shrubs or trees, rarely climbing; the pubescence of simple hairs. Flowers axillary, solitary or in few-flowered inflorescences; pedicels articulate, with a few small bracts (rarely foliaceous) below the articulation, no bracts above this. Sepals valvate. Petals imbricate, usually hairy, especially so outside at the base. Stamens numerous; connective expanded above the anther into a truncate disc; anther cells not locellate. Carpels numerous; ovule 1, basal, erect. Monocarps ovoid or ellipsoid, or shortly cylindrical-ellipsoid, 1-seeded, stipitate or rarely almost sessile. Seeds without an aril.

The genus is the largest in the family Annonaceae, the species numbering about 240. It is distributed from southern Mexico and the West Indies to Bolivia and southern Brazil, centering in the Amazonian region and Guiana.

a. Leaves not verrucose.
  b. Pubescence appressed.
    c. Leaves 3-5 cm. broad ..... 1. G. LUCENS
    cc. Leaves broader than 6 cm.
      d. Leaves rounded and a little emarginate at the base ..... 2. G. AMPLIFOLIA
      dd. Leaves acute at the base.
        e. Petals oblong, all of about the same length ..... 3. G. INUNCTA
        ee. Petals broadly ovate to orbicular, the inner shorter.
          f. Petioles 1.0-1.5 cm. long, the upper half narrowly winged; lateral nerves elevated on the upper side of the leaves ..... 4. G. SLATERI
          ff. Petioles 3-7 cm. long; lateral nerves impressed on the upper side ..... 5. G. PANAMENSIS
  bb. Pubescence spreading.
    c. Leaves oblanceolate to obovate; flower pedicels 8-10 mm. long. .... 6. G. ALLENII
    cc. Leaves linear-oblong; flower pedicels about 20 mm. long .... 7. G. CHIRIQUIENSIS

aa. Leaves very verrucose on both sides.
  b. Branchlets, pedicels and under side of the leaves with spreading pubescence; leaf-petioles 1-2 mm. long ..... 8. G. AERUGINOSA
  bb. Branchlets, pedicels and under side of the leaves with appressed pubescence; leaf-petioles 6-8 mm. long ..... 9. G. DUMETORUM

1. Guatteria lucens Standl. in Trop. Woods 42: 22. 1935; R. E. Fries, in Acta Hort. Berg. 12: 481, *pl. 34*. 1939.

A small tree, the young branchlets sparsely sericeous, soon glabrous and blackening. Leaves with petioles 6-8 mm. long, lustrous on both sides, finally glabrous above except on the more or less hirsute midrib, sparsely appressed-hairy beneath, oblong-lanceolate, acute and decurrent at the base, tapering at the apex into an acumen 1-2 cm. long, 10-16 cm. long and 3.5-4.5 cm. broad. Flowers 1 or 2 in the axils of persistent or newly fallen leaves; pedicels thin, rigid, black, sparsely sericeous, glabrescent, 10-13 mm. long, articulate 3-4 mm. above the base. Sepals rounded-ovate, about 2.5 mm. long. Petals green but blackening when dried, puberulous, sericeous outside at the base, oblong-spathulate, rounded at the apex,

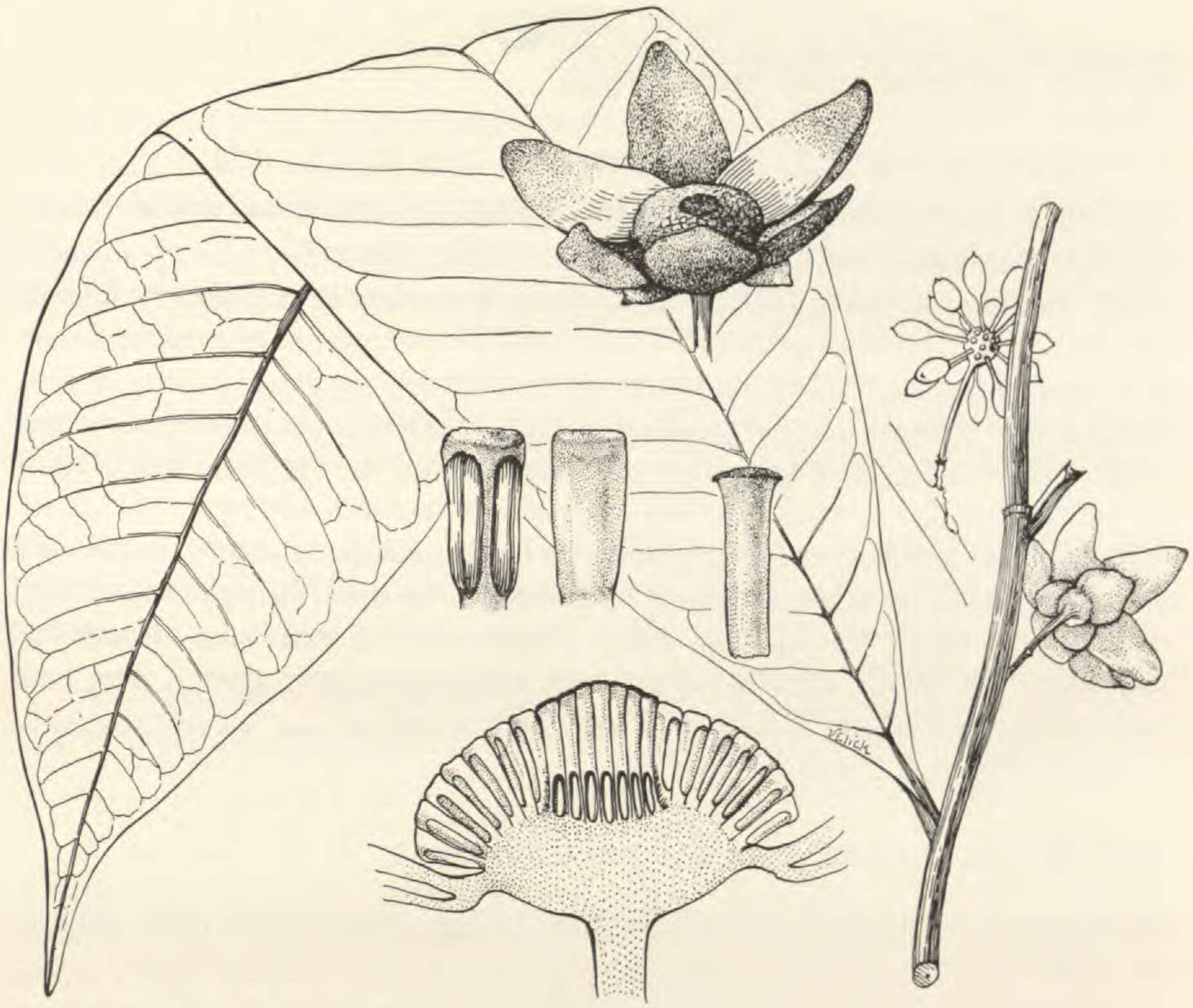

Figure 156. *Guatteria amplifolia*

the outer up to 12 mm. long and 4 mm. broad, the inner a little larger. Stamens 1 mm. long, connective disc very shortly setulose. (Fruits unknown).

SAN BLAS: Permé, *Cooper 280.*

2. GUATTERIA AMPLIFOLIA Tr. & Pl. in Ann. Sc. Nat., sér. 4. 17: 35. 1862; R. E. Fries, in Acta Hort. Berg. 12: 376, *fig. 12, a.* 1939.

Branchlets glabrous. Leaf petioles 4-5 mm. long, rugose, glabrous; blades papyraceous, glabrous above, sparsely provided beneath with very short appressed hairs, elliptic or oblong-elliptic or ovate, rotundate and a little emarginate at the very base, more or less abruptly cuspidate, 20-40 cm. long and 7-12 cm. broad; lateral nerves 18-25 on each side, more or less impressed on the upper side. Flowers solitary or sometimes 2; pedicels sericeous, 1-1.5 cm. long. Sepals triangular-ovate, reflexed, sericeous outside, tomentellous inside, 6-8 mm. long. Petals ferruginous-tomentellous on both sides, oblong-lanceolate, finally oblong-obovate, rotundate at the apex, 15-18 mm. long, 8-12 mm. broad. Stamens 1.8 mm. long. Monocarps ellipsoidic-pyriform, rugose, apiculate, 8-9 mm. long and 5 mm. across; stipes 10-15 mm. long, rigid.

CANAL ZONE: Chagres, *Fendler 3;* Lion Hill Station, *Hayes 346;* shores of Gatún Lake, *Bangham 464;* Barro Colorado Island: Barbour Point, *Shattuck 406,* and Chapman Trail, *Starry 170,* and Barbour-Lathrop Trail, *Starry 325.*

3. GUATTERIA INUNCTA R. E. Fries, in Acta Hort. Berg. 12: 378. 1939.

Guatteria Ouregou Griseb. Fl. Brit. W. Ind. 7.1860, pro parte quoad specimen a St. Thomas citatum, non Dunal.

A shrub or tree up to 8-10 m. high, young branchlets at first shortly ferruginous-sericeous. Leaves on petioles 5-8 mm. long, chartaceous, pale green and soon quite glabrous above, under side olivaceous and densely appressed-hirsute at first, finally nearly glabrous, elliptic to oblong-elliptic, broadest at the middle, acute and a little decurrent at the base, rather gradually tapering to the blunt apex, 15-28 cm. long and 6-12 cm. broad. Flowers 1-2; pedicels very thin but rigid, 1.5-2.0 cm. long. Sepals rotundate-ovate, ferruginous-sericeous outside, glabrous inside, 4-5 mm. long. Petals oblong and rotundate-truncate at the apex, ferruginous-sericeous outside, 10-15 mm. long, 5-8 mm. broad. Stamens 1.3-1.5 mm. long. Monocarps ellipsoidic, very shortly apiculate at the apex, acute at the base, about 7 mm. long and 4 mm. across; stipes thin, about 7 mm. long.

Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Water Valley, *Von Wedel 1460, 1716;* Old Bank Island, Isla Colón, alt. 0-120 m., *Von Wedel 1932.*

GUATTERIA INUNCTA, var. CAUDATA R. E. Fries, in Ann. Missouri Bot. Gard. 42: 152. 1955.

Differs from the type in the leaves, relatively narrower, narrowly cuneate at the base, with a narrowly caudiform apical acumen 2.0-3.5 cm. long, and in the more slender pedicels of the flowers.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Old Bank Island, *Von Wedel 2108.*

4. GUATTERIA SLATERI Standl. in Field Mus. Publ. Bot. 4: 206. 1929; R. E. Fries, in Acta Hort. Berg. 12: 517. 1939.

Tree up to 10 m. high, the young branchlets ferruginous-sericeous. Leaf petioles 1.0-1.5 cm. long, the upper part narrowly winged; blades blacken when drying, glabrous on upper side from the first, with sparse short appressed hairs beneath (longer on the midrib) and more or less glabrescent, elliptic to obovate, acute and long-decurrent at the base, rather abruptly contracted into an obtuse cusp 1-2 cm. long, 15-20 cm. long and 5-8 cm. broad. Flowers solitary, pedicels 1.5-2.0 cm. long, rigid. Sepals rotundate-ovate, about 4 mm. long and broad, soon recurvate, deciduous, sericeous outside, glabrous inside. Petals broadly ovate, rotundate at the apex, 8-12 mm. long and broad, golden yellow-sericeous outside, tomentellous inside, the inner a little smaller. Stamens 1.2-2.0 mm. long.

CHIRIQUÍ: Progreso, *Cooper & Slater, 177;* Bajo Chorro, Boquete District, in rain forest, alt. 6000 ft., *Davidson 233;* Boquete Region, Cerro Horqueta, cloud forest, alt. 6500 m., *Von Hagen & Von Hagen 2135.* BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 6000-7000 ft., *Allen 4802.*

5. GUATTERIA PANAMENSIS R. E. Fries, in Arkiv Bot. andra ser. 1: 335. 1950.

Guatteria costaricensis subsp. *panamensis* R. E. Fries, in Acta Hort. Berg. 12: 515. 1939.

A tree 10-15 m. high; branchlets ferruginous-sericeous. Leaves on petioles 3-7 mm. long, membranaceous, more or less blackening when dried, smooth above and hirsute at first at the midrib but soon quite glabrous, with appressed rigid hairs beneath, finally presumably glabrous, oblong or oblong-obovate, broadest at the middle or a little above the middle, acute at the base, abruptly contracted into a broad obtuse cusp 1 cm. long, 20-28 cm. long and 6-9 cm. broad. Flowers solitary or 2 in the axils of persistent or fallen leaves; pedicels sericeous, about 3 cm. long. Petals finally horizontally expanded, ovate and rotundate at the apex, the outer densely sericeous outside, tomentellous on the upper half inside, about 1 cm. long, the inner tomentellous outside and glabrous inside, a little smaller than the outer. Monocarps very numerous, ellipsoid to obovoid, shortly acute, 9-10 mm. long and 5.0-5.5 mm. across, abruptly tapering into a thin stipe 5-7 mm. long.

Known only from Panama.

BOCAS DEL TORO: region of Almirante, Daytonia Farm, *Cooper 382;* Old Bank Island vicinity of Chiriquí Lagoon, *Von Wedel 1965.*

6. GUATTERIA ALLENII R. E. Fries, in Arkiv Bot. andra ser. 1: 336. 1950.

A tree about 12 m. high; young branchlets very densely covered with rigid ferruginous erect-patent hairs. Leaves on petioles 2-3 mm. long, membranaceous, glabrous above except on the more or less tomentose midrib, pale green beneath and rather thinly clothed with decumbent or patent hairs, more densely along the thicker nerves, oblanceolate-obovate, tapering into a cuneate acute base, abruptly contracted at the apex into an acumen 0.5-1.0 cm. long, 10-18 cm. long and 3-7 cm. broad. Flowers solitary in the axils; pedicels thick, 8-10 mm. long, articulate about 2 mm. above the base. Sepals rotundate, about 4 mm. long and broad. Petals oblong, tapering towards the blunt apex, densely golden-sericeous on the outside, especially near the base, 10-15 mm. long and 5-6 mm. broad. Stamens with connectives 1.5 mm. long, disk velutinous. (Fruit unknown).

COCLÉ: north rim of El Valle, *Allen 1900.*

7. GUATTERIA CHIRIQUIENSIS R. E. Fries, in Svensk. Vet-Akad. Handl. ser. 3. 24^{10}: 11. 1948.

Young branchlets shortly ferruginous-hirsute. Leaf petioles 1-3 mm. long; blades glabrous above except on the densely tomentose midrib, underside rather sparsely clothed with patent ferruginous persistent hairs, linear-oblong, acute and shortly decurrent at the base, rather abruptly contracted into an obtuse cusp about 1.5 cm. long. Flowers solitary (or more?), their pedicels about 2 cm. long, rigid, articulate about 5 mm. above the base, the lower part sericeous, the upper provided with more patent ferruginous hairs. Sepals broadly ovate, acute, ferruginous-sericeous outside, glabrous inside, about 5 mm. long. Petals thick, horizontally expanded, elliptic-oblong and rotundate at the apex, densely golden-sericeous

outside, subglaucous inside, pulverulent upwards on both sides. Stamens 1.7-2.0 mm. long. Monocarps black, narrowly ellipsoidic-clavate, 9-10 mm. long and 4-5 mm. broad on stipes 6-7 mm. long.

CHIRIQUÍ: vicinity of San Félix, alt. 0-120 m., *Pittier 5132, 5748.*

8. GUATTERIA AERUGINOSA Standl. in Field Mus. Publ. Bot. 4: 206. 1929.

Tree about 15 m. high; young branchlets densely clothed with short ferruginous hairs. Leaves on very short petioles (1-2 mm. long), 14-18 cm. long and 4-5.5 cm. broad, oblong to oblanceolate and broadest above the middle, shortly narrowed to the base, long-cuspidate at the apex, verruculose-punctate on both sides, ferruginous-pilose on the midrib above and finally glabrous, densely rubiginous-pilose beneath, later thinly ferruginous-hirsute, the hairs rather long-patent and soft. Flowers solitary; pedicels thick, rigid, densely pilose, 1-3 cm. long, articulate 3-4 mm. above the base, Petals thick, finally horizontally expanded, sericeous-tomentellous on the outside, tomentellous on the inside except at their glabrous base, ovate to oblong-elliptic, the outer petals up to 13 mm. long and 6-8 mm. broad, the inner a little shorter. Stamens 1.5-1.7 mm. long. Monocarps black, narrowly ellipsoid, acute at both ends, 10 mm. long and 4 mm. across.

BOCAS DEL TORO: *Von Wedel 155, 490;* Isla Colón vicinity of Chiriquí Lagoon, *Von Wedel 2856;* Cricamola, near Almirante, *Cooper 526, 526a.*

9. GUATTERIA DUMETORUM R. E. Fries, in Svensk. Vet.-Akad. Handl. ser. 3, 24^{10}: 12. 1948.

Young branchlets appressed-hairy, glabrescent. Leaf petioles 6-8 mm. long; blades densely verrucose on both sides, hirsute at first above but soon quite glabrous, underside covered at first with long more or less ferruginous appressed hairs, finally nearly glabrescent but still with some hairs especially on the midrib, oblanceolate, gradually tapering and decurrent at the base, rather abruptly contracted at the apex into an obtuse acumen 1-1.5 cm. long, about 15 cm. long and 4-5 cm. broad. Flowers 1-2 in the axils of leaves; pedicels thin, sparsely sericeous, about 2 cm. long, articulate about 0.5 cm. above the base. Sepals finally recurvate, ovate, acute, densely sericeous outside, glabrous inside, 3-4 mm. long. Petals oblong to rhombic-ovate, narrowed to the obtuse apex, 10 mm. long and 4-5 mm. broad, flavescent-tomentellous outside; outer petals pubescent at the base, inner petals with longer appressed golden-yellow hairs nearly up to the apex. Stamens 1 mm. long, the connective disk plane, glabrous. (Fruit not known).

COLÓN: along Río Fató, in forests and thickets, alt. 10-100 m., *Pittier 3915.*

4. UNONOPSIS R. E. Fr.

UNONOPSIS R. E. Fries, in Svensk. Vet.-Akad. Handl. 34^{5}: 26. 1900.

Shrubs or small to medium-sized trees. Inflorescences axillary or sometimes produced from older branches or from the trunk; pedicels articulate above the basal bract and provided with a second bract above the articulation. Flowers small, the

buds spherical. Sepals minute, valvate. Petals rigid, valvate, ovate or rotund, concave, the inner thick in particular; pollen sacs not locellate; connective expanded above the anther into a truncate disk. Carpels several to numerous; ovules (up to 6-8), lateral, or else solitary and attached near the lower or upper end of the ovary. Monocarps free, stipitate.

A large genus of about 30 species, inhabiting a vast area from British Honduras and the West Indies to south Brazil; only 2 species recorded from Panama.

a. Leaves elliptic to obovate-elliptic, 20-30 cm. long; pedicels thin, 2-4 cm. long; ovules solitary ..... 1. U. PITTIERI.

aa. Leaves oblong-oblanceolate, 15-20 cm. long; pedicels short and thick (circ. 7 mm. long—or more?); ovules 3-4, lateral ..... 2. U. PANAMENSIS

1. UNONOPSIS PITTIERI Saff. in Journ. Washington Acad. Sci. 15: 102. 1925.

Trees of moderate size, 10 m. tall, with pyramidal crown; young branches minutely sericeous, becoming glabrous and blackish, densely lenticellate, the stouter with grayish bark. Leaf petioles at first puberulent, becoming glabrous and blackish, 3-5 mm. long, flat or channelled above; blades membranaceous-papyraceous, almost concolorous, at first sericeous on both sides but soon glabrescent, beneath with some more or less persistent hairs along the midrib or completely glabrous, the whole surface finely verruculose-punctate, elliptic or obovate-elliptic, narrowed toward the base and broadly acute or obtusish, cuspidate at the tip, 20-30 cm. long and 5-9 cm. broad, the veins on both sides prominent, 12-15, arcuate, irregularly gathered toward the margin. Inflorescences on leafless branches, about 1 cm. thick; pedicels thin, minutely sericeous, 2-4 mm. long, articulate about midway and bearing a minute bracteole. Sepals 1.5 mm. long, sericeous without, triangular and strongly connate. Petals valvate, broadly ovate, acute, the outer rather thick, glaucous-sericeous without, about 9 mm. long and 7 mm. broad, the inner thicker, 5-6 mm. long and 4-5 mm. broad, the midrib sericeous without but otherwise glabrous. Stamens 1.5 mm. long. Pistils 14-18, the ovaries cylindric-prismic, glabrous save the hairy angles, 1.5-1.7 mm. long, the stigmas conic-ovoid, 1 mm. long, the ovules solitary, attached below midway, horizontal. Monocarps brown, globose, 11-12, glabrous, with a stipe about 1 cm. long.

CANAL ZONE: headwaters of Rio Chinilla, above Nuevo Limón, *Maxon 6890*. COLÓN: along the Río Fató, in forests or thickets, alt. 10-100 m., *Pittier 3871*.—Also reported by Standley from Barro Colorado Island.

This species occurs also in Costa Rica, from whence the very closely related *U. schippii* is described.

2. UNONOPSIS PANAMENSIS R. E. Fries, in Ann. Missouri Bot. Gard. 42: 151. 1955.

Young branches with short ferruginous erect or appressed hairs. Leaf petioles terete or flattened above, tomentellous, 4-5 mm. long; blade chartaceous, above glabrous save for the minutely hairy glabrescent midrib, beneath hirsute-glabrescent along the midrib, oblong-oblanceolate, broadest above the middle, shortly acute at the base, abruptly contracted at the tip with a cusp 1.0-1.5 cm. long, 15-20 cm. long and 4-5 cm. broad, the midrib elevated on both sides, the stronger veins

Figure 157. *Unonopsis panamensis*

about 15 on both sides, arcuately ascending and converging about 1-2 mm. from the margin, slender and prominent above. Inflorescences springing from the axils of fallen leaves; pedicels thick, ferruginous-sericeous, 7 mm. long or longer, articulated slightly above the base. Sepals free, rotund-ovate, acutish, about 2 mm. long. Petals stiff, blackening in desiccation, the outer rotund, about 7 mm. in diameter and ferruginous-sericeous without, the inner smaller, ferruginous-tomentose along the midrib. Stamens 1.8-2.0 mm. long, truncate at the tip. Ovaries 1.5 mm. long, prismatic and shortly strigose, tipped with a globose-ovoid stigma; ovules 3-4, lateral. (Fruit unknown.)

Known only from Panama.

PANAMÁ: Cerro Campana, trail from Campana to Chica, alt. 600-800 m., *Allen 2647*.

5. XYLOPIA L.

XYLOPIA L. Syst. ed. 10. 1759; R. E. Fries, in Acta Hort. Berg. 10: 85. 1930.

Shrubs or trees. Flowers usually small, sessile or shortly pedicellate, in axillary inflorescences or sometimes produced from old branches or from the trunk. Sepals small, valvate in bud, nearly free or connate into a cupular calyx. Petals thick, valvate, linear-oblong or sometimes deltoid. Stamens numerous, the anther cells locellate; connective expanded above the anther. Ovaries hidden in a deep cavity in the center of the torus; ovules lateral. Monocarps free, cylindric or sometimes short, clavate, containing a row of rather few seeds.

About 50 species in America, distributed from Central America and the West Indies to southern Brazil and Paraguay; also in the tropics of the Old World. Only 4 species are known at present from Panama.

a. Sepals nearly free or connate up to the middle; carpels few (4-8).
   b. Flowers numerous in axillary inflorescences; flower buds elongate, cylindric-trigonous; petals linear-oblong ..... 1. X. FRUTESCENS.
   bb. Flowers solitary; flower buds ovoid; petals flat, the outer ovate..... 2. X. BOCATORENA.

aa. Calyx cup-shaped with almost wholly connate sepals; carpels numerous (25-45).
   b. Flowers numerous in axillary inflorescences; flower buds narrowly cylindric-trigonous; outer petals 2-3 mm. broad ..... 3. X. AROMATICA
   bb. Flowers solitary, axillary; flower buds thick, cylindric; outer petals about 8 mm. broad ..... 4. X. MACRANTHA.

1. XYLOPIA FRUTESCENS Aubl. Pl. Guy. Fr. 1:602, *t. 292*. 1775, excl. syn. Linn. et Brownei.

Xylopia setosa Poir. in Lam. Encycl. Méthod. 18: 812. 1808.

Xylopia muricata Vell. Fl. Flumin. 9: *t. 127*. 1827; non Linn.

A medium-sized tree or shrub; young branchlets densely covered with about 2 mm. long, more or less ferruginous, erect-patent hairs. Leaves rigid, glabrous on upper side, densely covered underneath with long appressed hairs, lanceolate, acute at the base, rather long-acuminate, 4-6 cm. long and 0.8-1.5 cm. broad; petioles 2-4 mm. long. Inflorescences 1-5-flowered, axillary. Sepals ovate, about 2 mm. long,

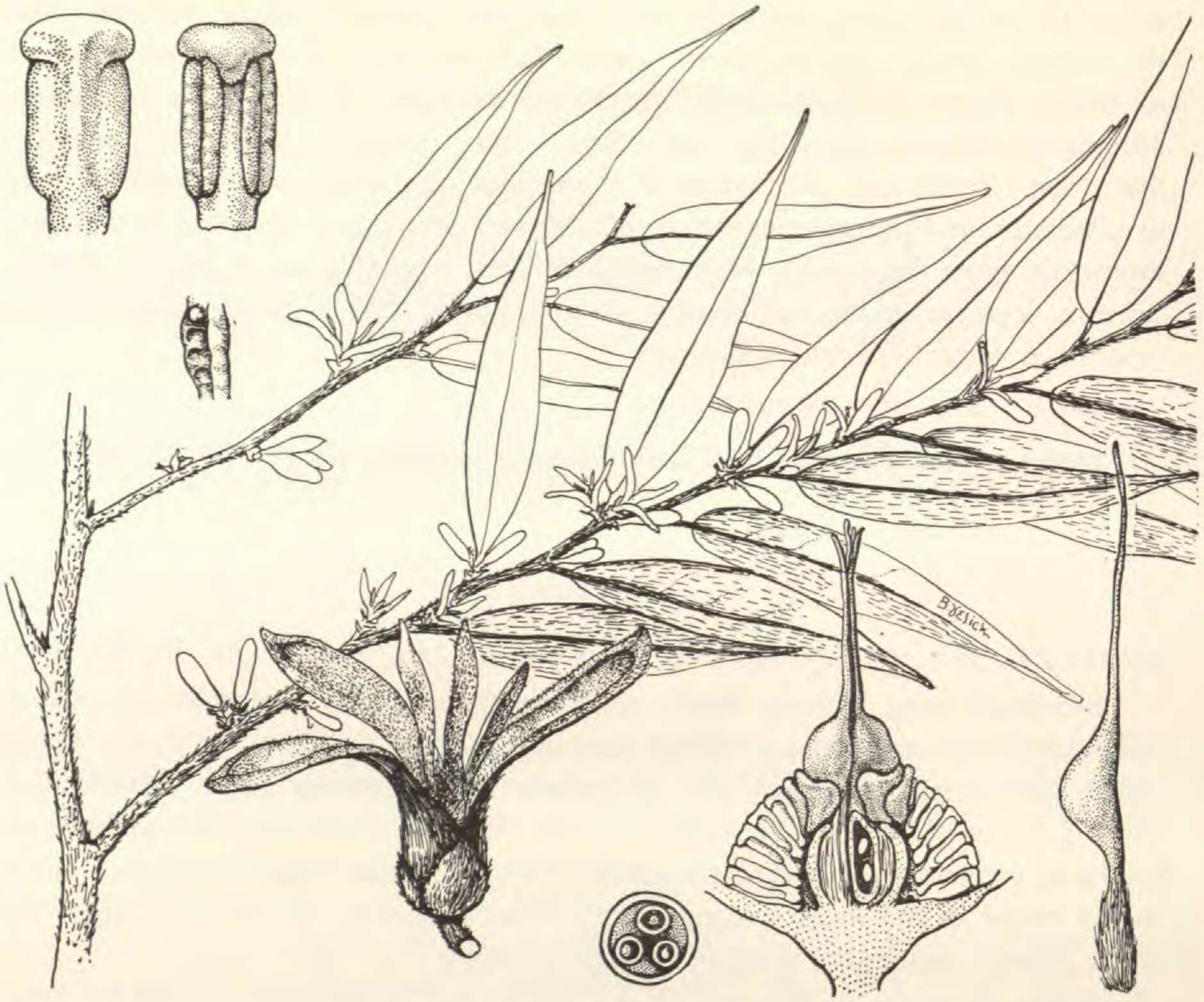

Figure 158. *Xylopia frutescens*

shortly connate at the base. Outer petals 8-11 mm. long and 2.5 mm. broad, oblong-obtuse, sericeous; inner petals a little shorter and narrower. Carpels 6 (or more ?); style with stigma 4 mm. long, glabrous, curvate and thickened above the base. Monocarps 10-13 mm. long and 9-10 mm. broad, rhomboid-globose, obtuse, contracted at the base into a stipe 1-2 mm. long. Seeds 2 (or 1), ovoid, black, 6-7 mm. long.

Distributed from Central America (Guatemala and British Honduras) to southern Brazil (Rio de Janeiro and Minas Geraës).

CANAL ZONE: low hill north of Balboa, *Gillespie P 33;* Barro Colorado Island, *Shattuck* 250. PANAMÁ: Sabana, *Pittier* 2539 Panamá, *Haenke 167, Seeman s.n.;* vicinity of Arraiján, *Allen 1765;* Isthmus of Panamá, in woods, *Hayes 670;* Punta Paitilla, *Piper 5410;* vicinity of Juan Franco Race Track, *Standley 27760.*

2. XYLOPIA BOCATORENA Schery, in Ann. Missouri Bot. Garden 30:86. 1943.

Tree, its young branchlets very shortly and densely tomentellous. Leaves rigid, on petioles 2-3 mm. long, elliptic-lanceolate, acute at the base, long acuminate at the apex, glabrous above, thinly provided beneath with short appressed hairs, 8-11

cm. long, and 2.3-3.5 cm. broad. Flowers solitary; pedicels sericeous, often recurved, 5-6 mm. long; flower buds ovoid, about 1 cm. long. Sepals connate up to the middle. Petals flat; the outer ovate, sericeous outside, about 12 mm. long and 6 mm. broad; the inner rhombic-lanceolate, 11 mm. long and 4-5 mm. broad. Stamens 3 mm. long, connective appendage ellipsoid. Carpels about 8. Monocarps 1-4 (or more), obovoid to clavate, ca. 2 cm. long. Seeds 2, black.

BOCAS DEL TORO: Isla Colón, vicinity of Chiriquí Lagoon. *Von Wedel 2965.*

3. XYLOPIA AROMATICA (Lam.) Eichl. in Mart. Fl. Bras. 13[1]: 43. 1841; R. E. Fries, in Acta Hort. Berg. 10: 106. 1930 (where 23 synonyms are quoted).

A tree; young branchlets tomentose. Leaves large, 8-15 cm. long and 2.0-4.5 cm. broad, rigid, lanceolate or elliptic-lanceolate, gradually narrowing at the apex, rounded or shortly acute at the base, glabrous on the upper side from the first except on the midrib, covered underneath with short patent or appressed hairs or even glabrous, glaucous; petioles 3-6 mm. long. Flowers numerous in axillary inflorescences; flower buds long and narrow, trigonous, densely sericeous. Calyx cup-shaped, with almost wholly connate sepals. Outer petals linear, up to 30 mm. long and 2-3 mm. broad; inner petals a little shorter, about 1 mm. broad. Stamens 1.0-1.5 mm. long. Carpels very numerous (about 25). Monocarps cylindric, torulose, 2.0-2.5 cm. long and 6-7 mm. thick. Seeds about 6, ovoid, black, 5-6 mm. long.

This is the most widely distributed species of all American Xylopias, covering a large area from Central America and the West Indies down to southern Brazil and Paraguay.

PANAMÁ: sabanas near Chepo, 30 m., *Hunter & Allen 49;* Río Tataré, *Woodson & Schery 1018;* Isla Taboga, ca. 0-186 m, *Woodson, Allen & Seibert 1447;* Bohio, *Pittier 3417;* savanas north of Panamá city, *Brother Paul 443;* Island San José in sinu Panamensi, *Andersson s.n.*

4. XYLOPIA MACRANTHA Tr. & Pl. in Ann. Sc. Nat., sér. 4. 17: 38. 1862. R. E. Fries, in Acta Hort. Berg. 10: 112, *fig.* 8. 1939.

Young branchlets sericeous-villous. Leaves 3-4 mm. long, petiolate, coriaceous, glabrous and lustrous above, covered beneath with long appressed hairs, finally glabrescent, oblong, rounded at the base, gradually narrowed into an obtuse apex, 9-12 cm. long and 3-4 cm. broad. Flowers solitary in the axils of fallen leaves; pedicels thick, 5-6 mm. long. Sepals nearly wholly connate, forming a cup 8-10 mm. high and 10-11 mm. broad, ferruginous-sericeous on the outside. Petals thick, rigid, ligneous, 20-23 mm. long, the outer plane, oblong, sericeous on the outside, grey-tomentellous on the inner side, 8 mm. broad; inner petals quadrangular-prismatic, very acute, about 3 mm. in diameter, broadened at the base. Stamens 1.5-2 mm. long. Carpels numerous (about 45). Fruit unknown.

At first described from Colombia, but later found in many localities in Panama and Venezuela.

CANAL ZONE: along Caño Quebrado, *Pittier 6822;* Barro Colorado Island in Gatún Lake, alt. 120 m. or less, *Standley 41085;* hills north of Frijoles, *Standley 27483;* hills west of the Canal, near Gatún, *Standley 27211;* Barbour Point, *Bangham 490;* end of Van Tyne Trail, Barro Colorado Island, *Zetek 3903.* COLÓN: vicinity of Camp Pina, *Allen 3676.*

6. ANAXAGOREA St. Hil.

ANAXAGOREA St. Hil. in Bull. Soc. Philom. Paris 91. 1825; R. E. Fries, in Acta Hort. Berg. 12: 6. 1934.

Small trees or shrubs. Flowers small, axillary, sometimes produced on the older, leafless branches; pedicels bracteolate. Sepals thin, valvate in bud, free or sometimes connate at first and irregularly splitting, often deciduous. Petals valvate, all rather alike, but the inner mostly a little smaller and thicker, all, or only the inner, keeled on the inner surface above the middle. Stamens several, the innermost often sterile; connective of the fertile stamens not forming a disk above the pollen sacs, elongated into a ligule, sometimes very short. Carpels several; ovules 2, erect, produced from the basal part of ovary cavity. Monocarps free, dry, stipitate, club-shaped, opening along the inner sides. Seeds 2, very smooth and lustrous, appressed against each other and therefore plane on one side side and convex on the other.

A rather large genus, containing 20 American species occupying a vast region from Central America and Colombia to southern Brazil, centering along the Amazon.

a. Leaves smaller (8-16 cm. long), acute and long-decurrent at the base; the secondary nerves 7-8 *per side* ..... 1. A. PANAMENSIS.

aa. Leaves larger (30-35 cm. long), rounded at the base; the secondary nerves about 15 per side ..... 2. A. ALLENII.

1. ANAXAGOREA PANAMENSIS Standl. in Journ. Washington Acad. Sc. 15: 101. 1925; R. E. Fries, in Acta Hort. Berg. 12: 24. 1934.

A shrub up to 2 m. high; the young branchlets minutely ferruginous-puberulous, soon glabrescent. Leaves on petioles 4-7 mm. long, membranaceous, paler and puberulous beneath, finally glabrous on both sides, lanceolate-oblong, acute and decurrent at the base, rather gradually tapering at the apex, 8-16 cm. long and 3.0-4.5 cm. broad; secondary nerves 7-10 per side. Flowers solitary; pedicels 2.0-2.5 cm. long, finally glabrous, provided near the calyx with an orbicular, amplectant bract, 1 mm. long. Sepals membranaceous, ovate, acuminate, ferruginous-puberulous, 8 mm. long. Outer petals linear-oblong, obtuse, 2 cm. long; inner petals triangular-ovate, acuminate, ca. 1 cm. long. Monocarps glabrous but rugose, apiculate at the apex, 2.2-2.5 cm. long, together with the stipe.

PANAMÁ: in wet forest along the Río Tapía, near sea-level, *Standley 26168.*—According to Standley also collected on the hills north of Frijoles, Canal Zone: *Standley 27589.*

2. ANAXAGOREA ALLENII R. E. Fries, in Ann. Missouri Bot. Gard. 42: 151. 1955.

Tree about 6 m. tall; young branches very shortly rufous-tomentellous. Petiole of leaves 10-12 mm. long, thick; blade chartaceous in desiccation, yellowish green, very glabrous and smooth above, glabrous and paler beneath, oblong-lanceolate, rounded at the base, gradually narrowed toward the tip, 30-35 cm. long and 8-10 cm. broad,

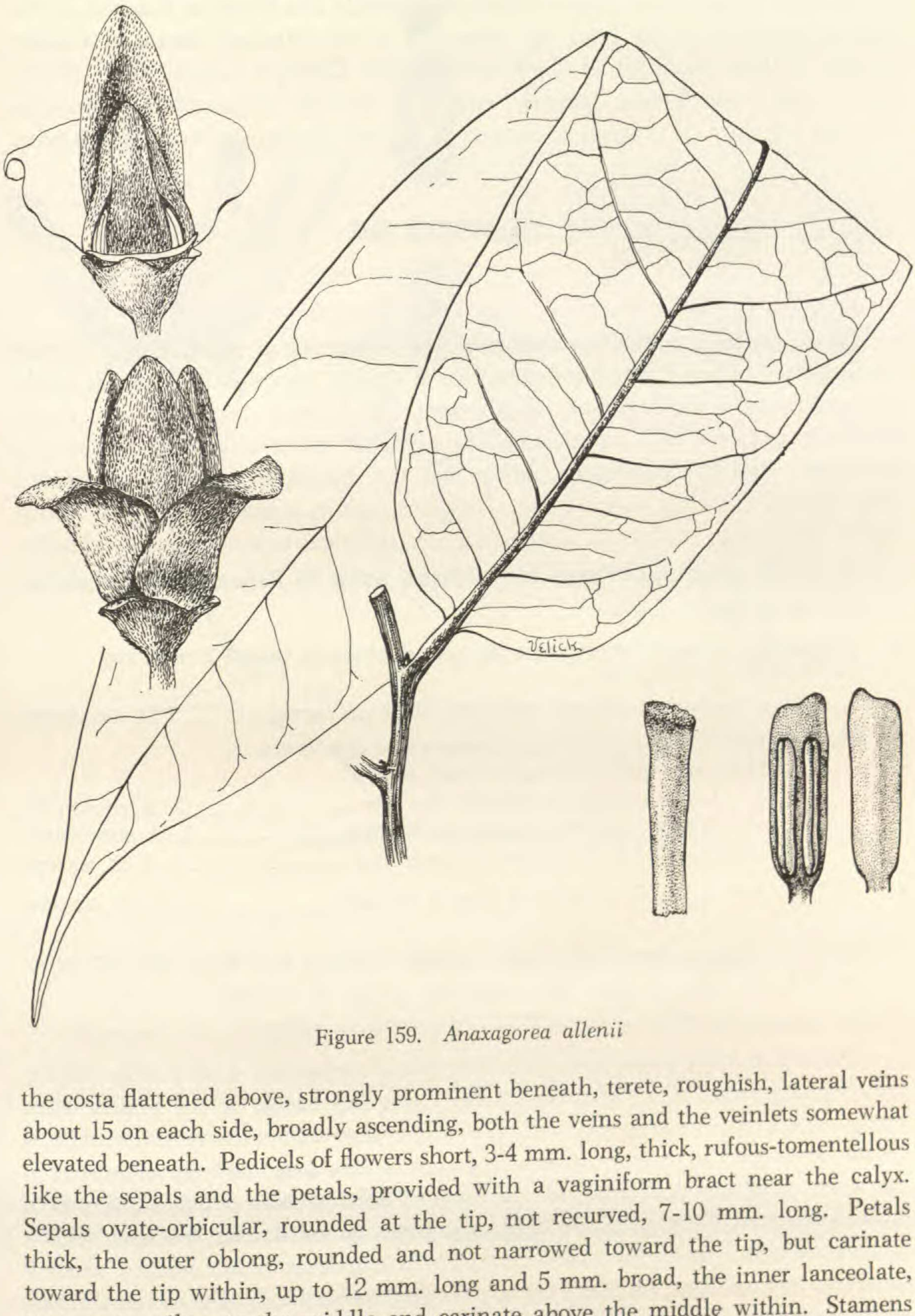

Figure 159. *Anaxagorea allenii*

the costa flattened above, strongly prominent beneath, terete, roughish, lateral veins about 15 on each side, broadly ascending, both the veins and the veinlets somewhat elevated beneath. Pedicels of flowers short, 3-4 mm. long, thick, rufous-tomentellous like the sepals and the petals, provided with a vaginiform bract near the calyx. Sepals ovate-orbicular, rounded at the tip, not recurved, 7-10 mm. long. Petals thick, the outer oblong, rounded and not narrowed toward the tip, but carinate toward the tip within, up to 12 mm. long and 5 mm. broad, the inner lanceolate, very acute, pilose to the middle and carinate above the middle within. Stamens linear, 3 mm. long, the appendage of the connective slender, about 0.7 mm. long, truncate-rounded. Fruit unknown.

CANAL ZONE: Quebrada López, alt. 30 m., *Allen 2143.*

Another species of the genus *Anaxagorea* certainly also occurs in Panamá, as the material available to me from the herbarium of the Missouri Botanical Garden includes a third, collected in the vicinity of the Chiriquí Lagoon (*Von Wedel 2210*). This lacks flowers, however, and it is therefore impossible to determine with any certainty its position in relation to hitherto known species of *Anaxagorea*.

7. DESMOPSIS Saff.

Desmopsis Saff. in Bull. Torrey Bot. Club 43: 184. 1916; R. E. Fries, in Acta Hort. Berg. 10: 16. 1930.

Shrubs or small to medium-sized trees; the pubescence of simple hairs. Flowers medium-sized in few-flowered inflorescences (rhipidia) opposite the leaves or rarely produced from the trunk; pedicels usually long with 2 bracts. Sepals valvate. Petals valvate in bud or a little imbricate at the apex, all rather alike, linear-oblong to lanceolate. Stamens numerous; pollen sacs not locellate; connective expanded above the anther into a truncate disk. Carpels several to numerous with 1-8 lateral ovules. Monocarps stipitate or rarely subsessile, spherical to shortly ovoid-cylindric.

About 13 species, distributed from Mexico down to Panama, one (*neglecta*) endemic on Cuba.

a. Inflorescence peduncle bearing near the apex a foliaceous bract 1-2 cm. long; flower pedicels 2-8 cm. long.
  b. Petals incurved at the tips; monocarps 10-12 cm. across .....1 D. panamensis
  bb. Petals not incurved at the tips; monocarps 6-8 mm. across.
    c. Monocarps with thin stipes 5-8 mm. long.
      d. Leaves acutely acuminate at the apex .....2. D. microcarpa
      dd. Leaves obtuse or rotundate at the apex .....3. D. bibracteata.
    cc. Monocarps with thick stipes 1-3 mm. long .....4. D. maxonii
aa. All bracts very small; flower pedicels about 1 cm. long .....5. D. brevipes.

1. Desmopsis panamensis (Rob.) Saff. in Bull. Torrey Bot. Club 43: 185, *pl.* 7. 1916; R. E. Fries, in Acta Hort. Berg. 10: 18, *fig.* 3, *b.* 1930.

Unona panamensis Rob. in Amer. Journ. Sci. 50: 175. 1895.

Tree 5-8 m. high, young branchlets ferruginous-tomentose. Leaf petioles tomentose, 3-4 mm. long; blades glabrous on the upper side except on the midrib when young, subglabrous underneath with the midrib and thicker nerves tomentellous, elliptic or elliptic-lanceolate, cuneate and acute at the base, obtusely acuminate at the apex, 10-20 cm. long and 4-8 cm. broad. Inflorescences opposite the leaves, 1- to 2-flowered; their peduncle 3-10 mm. long, provided near the apex with a cordate-orbicular, acute, foliaceous bract 1.5-2.0 cm. long; flower pedicel about 7 cm. long, tomentellous, generally curved, bearing below the middle and at the base on the secondary flower small bracts 1-3 mm. long. Sepals triangular, 2-3 mm. long. Petals linear-oblong from a broad base, revolute at the margins and incurved at the apex, 15-25 mm. long. Ovaries 7-15, ovules 2-8. Monocarps shortly cylindric, rounded at both ends, 14-18 mm. long and 10-11 mm. across; stipes 8-10 mm. long.

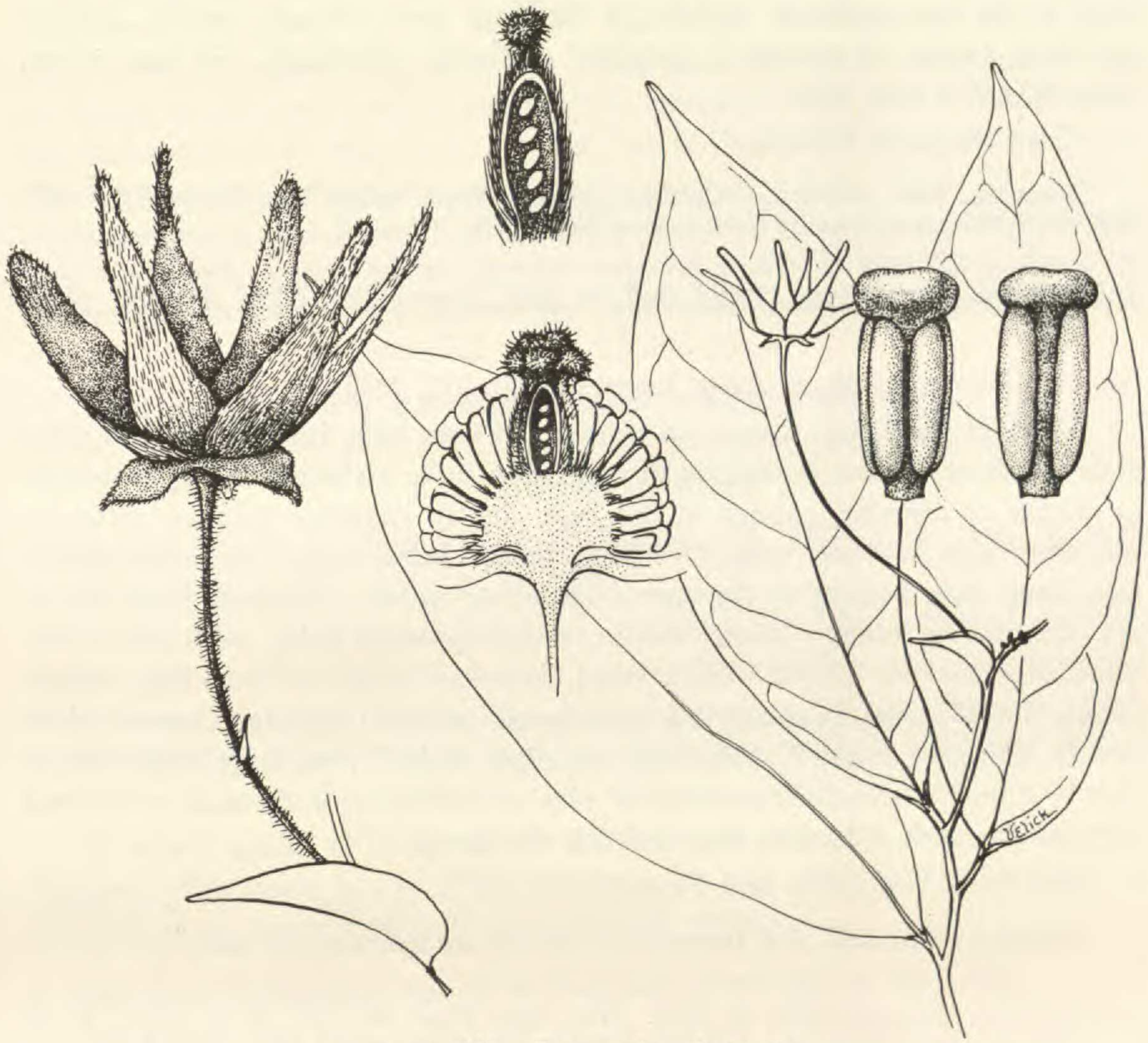

Figure 160. *Desmopsis microcarpa*

CANAL ZONE: woods near Gatún Station on the old Panamá Railway, *Hayes s.n.*; hills around the Agua Clara Reservoir, near Gatún, alt. 20-30 m., *Pittier 2660*.

Reported also from Barro Colorado Island (Standley, 1933).

2. DESMOPSIS MICROCARPA R. E. Fries, in Acta Hort. Berg. 10: 23. 1930.
Desmopsis glabrata Schery, in Ann. Missouri Bot. Gard. 28: 428. 1941.

Small tree 2-3 m. high, with the young branchlets thinly appressed-hirsute, very soon glabrescent. Leaves on petioles 3-4 mm. long, lanceolate-elliptic to broadly elliptic, rounded to cuneate at the base, rotundate and abruptly acuminate and more or less gradually tapering at the apex, glabrous above except on the more or less hirsute midrib, glabrous beneath, 10-20 cm. long and 4-10 cm. broad. Inflorescences up to 5-flowered; their peduncles about 1 cm. long and bearing near the apex a rotundate-cordate or foliaceous bract 1-2 cm. long; flower pedicels 5-8 cm. long, very slender, provided near the base and below the middle with 2 bracteoles 0.5-1.0 mm. long. Sepals ovate, 3-4 mm. long. Petals narrowly lanceolate, 4-6 mm.

broad at the base, gradually tapering to the blunt apex, sericeous outside, glabrous and black inside. Monocarps 7, spherical or shortly cylindrical, 7-8 mm. across; stipes thin, 6-8 mm. long.

Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Water Valley, *Von Wedel 1265, 1459, 1565, 1767, 2464;* exact locality lacking, *Von Wedel 279.*

3. DESMOPSIS BIBRACTEATA (Rob.) Saff. in Bull. Torrey Bot. Club. 43: 190, *pl. 9,* 1916.

Unona bibracteata Rob. in Amer. Journ. Sci. 50: 175, 1895.

Shrub or small tree. Leaves on petioles 2-3 mm. long, lustrous on both sides, glabrous above, hirsute beneath at first but soon quite glabrous, oblong-lanceolate or elliptic or rhombic, cuneate at the base, shortly angustate into an obtuse or rotundate apex, 5-14 cm. long, 2.5-5.5 cm. broad. Inflorescences on peduncles 2-5 mm. long, these bearing at the apex a rotundate-cordate, foliaceous bract 0.5-1.5 cm. long; flower solitary; pedicel slender, thinly appressed-hairy, 1.5-2.5 cm. long, provided below the middle with a small foliaceous bract 1-3 mm. long. Petals oblong 10(-18) mm. long and 4-6 mm. broad, sericeous outside. Ovaries 14-20, densely sericeous; ovules 3. Monocarps on stipes about 5 mm. long, subglobose or shortly cylindric, truncate-rotundate or even umbilicate at both ends, constricted between the seeds, 5-10 mm. long and 6-8 mm. broad.

Nicaragua, Costa Rica and Panama.

CHIRIQUÍ: *Pittier 3367, 5747* (according to Safford; the specimens not seen).

4. DESMOPSIS MAXONII Saff. in Bull. Torr. Bot. Club 43: 188, *pl 8.* 1916; R. E. Fries, in Acta Hort. Berg. 10: 24, *fig. 3, d-e.* 1930.

Tree 5-7 m. high with appressed-hairy branchlets. Leaves on petioles 5 mm. long, glabrous above, the underside pale fulvous-hirsute at first, finally quite glabrous, broadly elliptic or elliptic-oblong or lanceolate, acute and decurrent at base, acuminate, 10-14 cm. long and 4-8 cm. broad. Inflorescence peduncle 7-14 mm. long, bearing near the apex a suborbicular or broadly ovate, amplexicaul bract, 7-15 mm. broad, flower solitary, pale yellow; its pedicel 3.5-6.0 cm. long, curved, slender and thickened upwards, soon quite glabrous, below the middle bearing a small bracteole. Sepals broadly triangular, 4 mm. long. Petals all uniform, linear-oblong, obtuse, 13-18 mm. long and 4-5 mm. broad, clothed outside with gray appressed minute hairs. Pistils 10-15, ovules 2-5. Monocarps globose or obovoid, about 8 mm. across, subsessile or shortly stipitate, the stipes 1-3 mm. long and 1.5-2.0 mm. thick.

CHIRIQUÍ: in forest near El Boquete, alt. 1000-1300 m., *Pittier 3154;* in the humid forest along the upper Caldera River, above El Boquete, alt. 1450-1650 m., *Maxon 5564.*

5. DESMOPSIS BREVIPES R. E. Fries in Acta Hort. Berg. 13: 107. 1941.

A shrub or tree up to 10 m. tall, the young branchlets ferruginous-strigose, soon glabrescent. Leaf petioles 2-4 mm. long, appressed ferruginous-hirsute on both sides

when young, soon glabrescent, rounded or shortly acute at the base, rather abruptly cuspidate at the apex, 7-15 cm. long, 3-7 cm. broad. Inflorescences with 1-2 (or more ?) flowers opposite the leaves on young branchlets or rarely produced from the trunk; bracts small; pedicels rather thick, ferruginous-sericeous at first, more or less glabrescent, 8-10 mm. long, provided below the middle with a small bract (0.5-1.0 mm. long). Sepals rounded-deltoid, sericeous outside. Petals all uniform, linear-elongate from a dilated base, gradually narrowed into a more or less incurved apex 20-25 mm. long. Ovaries densely sericeous; ovules 3. Monocarps about 12, tomentellous at first, finally glabrescent, black when dried, very shortly stipitate, ellipsoid to more or less spherical, about 1.5 cm. across.

BOCAS DEL TORO: vicinity of Nievecita, *Woodson, Allen & Seibert 1864.*

8. STENANONA Standl.

STENANONA Standl. in Field Mus. Publ. Bot. 8: 205. 1929; R. E. Fries, in Acta Hort. Berg. 10: 151. 1931; 13: 103. 1941.

Small trees. Flowers medium-sized, on short pedicels. Sepals 3, valvate, caudate. Petals 6, biseriate, all similar, long caudate-cuspidate, the outer imbricate and connate with the inner at the base. Stamens numerous; filaments short; anthers oblong, extrorse; pollen sacs not locellate; connective elongated into a deltoid ligule above the anthers. Carpels numerous; ovules 2, lateral.

A small genus of 2 species, 1 of them occurring in Costa Rica, 1 in Panama.—The genus is very little known so far, and more complete material is desirable for a determination of its systematic position.

1. STENANONA PANAMENSIS Standl. in Field Mus. Publ. Bot. 8: 205. 1929.

Tree about 6 m. high; branchlets densely covered with fulvous patent hairs 1.5-2.0 mm. long. Leaves on petioles 2-4 mm. long, membranaceous, sparsely hairy on the upper side, glabrescent, fulvous-hirsute beneath, oblong or obovate-oblong, abruptly acuminate, rotundate or subcordate at the base, 8-18 cm. long and 2.5-6.5 cm. broad. Pedicels hirsute, up to 5 mm. long, bracteate; bract superior, lanceolate, long-acuminate, about 1 cm. long. Sepals ovate, abruptly long-acuminate, 15 mm. long, 5 mm. broad at the base, hirsute on the outside. Petals about 7 cm. long, fleshy, reddish, pilose, 4-5 mm. broad at the base, 0.6 mm. at the apex.

BOCAS DEL TORO: Daytonia Farm, *region of Almirante. Cooper 427.*

9. MALMEA R. E. Fries

MALMEA R. E. Fries, in Arkiv Bot. 5^4: 3. 1905; in Acta Hort. Berg. 10: 37. 1939.

Trees and shrubs. Flowers medium-sized or large, in few- to several-flowered inflorescences opposite the leaves, or rarely pseudo-axillary; pedicels articulated immediately above a nearly basal bract and bearing another bract above the articulation. Sepals small, with thin margins, imbricate in bud. Petals much longer than the sepals, more or less blackening when dried, orbicular-elliptic, imbricate in bud, their margins thin and more or less crispate. Stamens very numerous, the

Figure 161. *Stenanona panamensis*

connective expanded above the anther into a truncate disk; pollen sacs not locellate. Carpels numerous, containing 1 basal, erect ovule. Monocarps free, stipitate, 1-seeded.

Twelve species are known of this genus, 8 inhabiting Ecuador, the Amazonian region and Guiana; 1 is native to Bahia, and 3 are found in Central America (Mexico to Panama). Only 1 species is recorded from Panama.

1. MALMEA HYPOGLAUCA (Standl.) R. E. Fries, in Acta Hort. Berg. 10: 321. 1931.
Guatteria hypoglauca Standl. in Field Mus. Publ. Bot. 4: 207. 1929.

A tree up to 10 m. high; young branchlets glabrous. Leaves on petioles 5-6 mm. long, glabrous and glaucous beneath, elliptic or oblong-elliptic, rounded at the base and shortly decurrent, shortly acuminate at the obtuse apex, 12-14 cm. long and 5-6 cm. broad. Inflorescences terminal (or opposite the leaves ?); pedicels about 5 mm. long, thinly ferruginous-hirsute. Sepals 2-3 mm. long. Petals thick and glabrous, blackening when dried, elliptic-obovate and rotundate at the apex, 15-18 mm. long and 11-12 mm. broad. Stamens 2 mm. long. Fruit unknown.

SAN BLAS: Permé, *Cooper 661*.

This species is also found in Colombia (Department of Antioquía).

10. PORCELIA R. & P.

PORCELIA R. & P., Fl. Peruv. & Chil. Prodr. 84, *tab. 16*. 1794; R. E. Fries, in Acta Hort. Berg. 10: 28, *fig. 4*. 1930.

Trees. Leaves ovate to lanceolate-oblong, nearly glabrous, with translucent glands. Flowers medium-sized, bisexual or polygamous, terminal or opposite the leaves, often produced on axillary, very reduced branchlets (pseudo-axillary flowers); pedicels articulate at the base, without bracts. Sepals small. Petals imbricate in bud and finally widely spreading, all of about the same size, oblong-ovate or obovate. Stamens numerous; pollen sacs locellate; connective expanded above the anther into a truncate disk. Ovules numerous, lateral. Monocarps (sometimes very) large, free, stipitate, ellipsoid-cylindric, with large, reniform seeds.

A small genus of 5 species. Two of them (*macrocarpa* and *goyazensis*) are indigenous in eastern Brazil, 1 (*nitidifolia*) in Peru and Ecuador, 1 (*steinbachii*) in eastern Bolivia and adjacent parts of the Amazonas basin and 1 (*magnifructa*) in Panama and Venezuela.

1. PORCELIA MAGNIFRUCTA (Schery) R. E. Fries, in Arkiv Bot. andra ser. 1: 343. 1950.
Cymbopetalum magnifructum Schery, in Ann. Missouri Bot. Gard. 30: 87. 1943.

A tree about 12 m. high; young shoots and pedicels densely tomentellous, ochraceous, finally glabrous. Leaves on petioles 2-8 mm. long, ovate to oblong, rotundate to shortly acute at the base, longer acuminate at the apex, grey-ochraceous

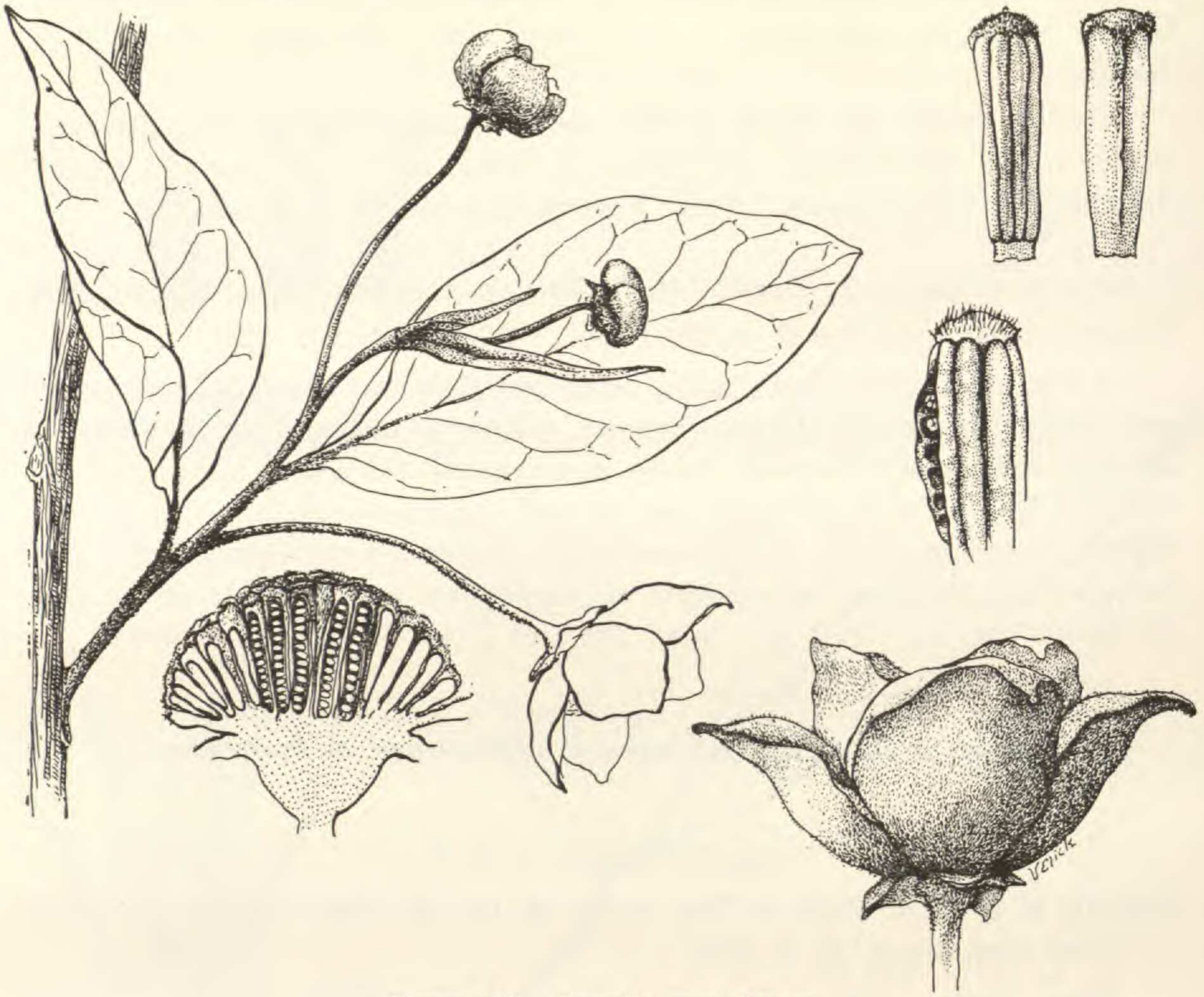

Figure 162. *Porcelia magnifructa*

tomentellous at first on both sides, especially beneath, soon glabrescent with translucent glands, up to 15 cm. long and 4-5 cm. broad. Pedicels 2-3 cm. long, without bracts. Sepals ovate, 3-5 mm. long, grey-tomentellous. Petals ovate, the apex rotundate and more or less incurved when dried, up to 17 mm. long, tomentellous on both sides. Stamens 2.5-3.0 mm. long, pollen sacs locellate. Carpels 10-15. Monocarps large, 6-10 cm. long and about 6 cm. across, ovoid; pericarp thick, ligneous. Seeds 2.5-3.0 cm. long.

PANAMÁ: vicinity of Bejuco, alt. ca. 50 m., *Allen 2455*.—Apparently also in Venezuela.

11. CYMBOPETALUM Benth.

CYMBOPETALUM Benth. in Journ. Linn. Soc. 5: 69. 1861; R. E. Fries, in Acta Hort. Berg. 10: 180. 1931.

Trees or shrubs with large, rather thin leaves. Flowers solitary, usually produced from the internode above the axil, sometimes terminal or rarely pseudoaxillary; pedicels often long, articulate at the base, without bracts. Perianth segments valvate in bud; sepals small; outer petals flat and thin, the inner longer, thick and fleshy with involute margins, cymbiform. Stamens numerous; pollen sacs

locellate; connective expanded above the anther into a truncate disk. Fruit of several free, oblong-cylindric monocarps, containing several (4-14) lateral seeds.

A small genus of 19 species, distributed from Mexico to Brazil (Rio de Janeiro). Only 3 species are found in Panama.

a. Pedicels 5 cm. long or generally much longer; flowers large; inner petals 2.5-3.5 cm long; stamens 4.0-4.5 mm. long.
   b. Leaves obovate-oblanceolate, long-cuneate at the base. .....1. C. BRASILIENSE.
   bb. Leaves narrowly oblong-lanceolate, rounded-acute at the base. 2. C. LANUGIPETALUM.

aa. Pedicels about 3 cm. long; flowers small; inner petals 1.5 cm. long; stamens 2.0-2.5 mm. long .....3. C. COSTARICENSE.

1. CYMBOPETALUM BRASILIENSE (Vell.) Benth. in Journ. Linn. Soc. 5: 69. 1861; R. E. Fries, in Svensk. Vet.-Akad. Handl. ser. 3. 24[10]: 29. 1900.

Uvaria brasiliensis Vell. Fl. Flumin. 238. 1825; 5: *tab. 122.* 1827; Eichl. in Mart. Fl. Bras. 13[1]: 39, *tab. 13, fig. 2.* 1841.

Unona viridiflora Splitg. in Nederl. Kruidk. Arch. 1: 224. 1848.

Uvaria viridiflora Walp. Ann. Bot. Syst. 2: 19. 1851.

Eschweilera simplex Miers, in Trans. Linn. Soc. 30: 264. 1875.

Trigynaeia anastomosans Rusby, Descr. New Species of S. Amer. Plants 19. 1920.

Uva brasiliensis O. Ktze. Rev. Gen. 7. 1891.

A small tree with shortly puberulous branchlets, soon glabrescent. Leaves on petioles 3-4 mm. long, membranaceous, glabrous and densely pellucid-punctate, obovate, oblanceolate, or lanceolate-elliptic, cuneate-angustate toward the base, 15-30 cm. long and 6-10 cm. broad. Pedicels 5-9 cm. long, glabrous. Sepals connate at the base, rounded-reniform, obtusely acuminate, 4-6 mm. long and 6-9 mm. broad. Petals tomentellous on both sides, the outer ovate or rotundate, flat, 2.0-2.5 cm. long and 2-3 cm. broad, the inner thick, rounded-elliptic, obtuse, 2.5 -3.5 cm. long and 1.8-2.3 cm. broad, the margins involute. Stamens 4.0-4.5 mm. long. Monocarps numerous, oblong-cylindric, and more or less curved, torulose, rounded at both ends, up to 3.5 cm. long and 1.5 cm. broad. Seeds up to 6, but generally fewer.

This species is distributed in eastern South America from Trinidad and Venezuela down to Rio de Janeiro; in western South America from Panama to south Colombia.

DARIÉN: Río Cuasi, alt. 800 ft., *Terry & Terry 1417.*

2. CYMBOPETALUM LANUGIPETALUM Woods. & Schery, in Ann. Missouri Bot. Gard. 28: 427. 1941.

Tree; young branchlets very shortly appressed-hirsute. Leaves on very short petioles (1-2 mm. long), rigid, glabrous on both sides, oblong-lanceolate, rounded or very shortly acute at the base, gradually tapering toward a long narrow cusp, 15-30 cm. long and 5-7 cm. broad, the nerves impressed on the upper side, very prominent beneath. Flowers solitary; pedicels glabrous, pendulous, about 20 cm.

Figure 163. *Cymbopetalum lanugipetalum*

long. Sepals small, about 0.3 cm. long. Outer petals flat and thin, subtriangular, 1.8-2.0 cm. long and 1.0-1.6 cm. broad, the inner fleshy and tomentellous, triangular-ovate, cymbiform, about 3 cm. long and 1.5 cm. broad. Stamens 4-5 mm. long, the pollen sacs locellate, the connective-appendage globose, setulose.

COCLÉ: north rim of El Valle de Antón near Cerro Turega, alt. 650-700 m., *Woodson & Schery 191a.*

3. CYMBOPETALUM COSTARICENSE (Donn. Sm.) R. E. Fries, in Acta Hort. Berg. 10: 186, *fig. 6 a-c d.* 1931.

Asimina costaricensis Donn. Sm. in Bot. Gaz. 23: 2. 1897.

Tree or shrub; young branchlets sparsely clothed with very short appressed hairs, soon glabrescent and densely provided with lenticels. Leaves on petioles 4-6 mm. long, membranaceous, finally glabrous, verruculose along the thicker nerves, oblong, elliptic-oblong or obovate, cuneate at the base, rather abruptly cuspidate, 10-22 cm. long, 4.0-6.5 cm. broad. Pedicels about 3 cm. long. Sepals rounded-ovate, shortly apiculate, about 4 mm. long. Petals grey-tomentellous, the outer flat, broadly ovate, acute, up to 12-13 mm. long, the inner obovate-rotundate, about 17 mm. long and 10 mm. broad, narrowed at the base into a petiole 5 mm. long, the margins of the upper part striate and involute. Stamens 2.5 mm. long, connective-disk plane and tomentellous. Monocarps 8-10, shortly cylindric, not torulose, 3-5 cm. long and about 1.7 cm. thick. Seeds 12-14.

Costa Rica and Panama.

BOCAS DEL TORO: Daytonia Farm, *Cooper 624;* vicinity of Chiriquí Lagoon, Water Valley, *Von Wedel 693, 1768.*

12. DUGUETIA St. Hil.

DUGUETIA St. Hil. Fl. Bras. Mer. 1: 35, *t.* 7. 1825; R. E. Fries, in Acta Hort. Berg. 12: 28. 1934.

Trees or shrubs with stellate hairs or stellate scales. Flowers medium-sized or large in few- or multi-flowered inflorescences; these more or less strictly opposite the leaves, or sometimes produced from older branches or from the trunk. Sepals valvate. Petals free, generally imbricate in bud. Stamens numerous; connective generally expanded above the anther into a truncate disk. Carpels numerous; ovules solitary, basal, erect. Monocarps sessile, closely crowded, ligneous or fleshy, easily separable or more or less coherent.

A large genus (about 70 species), distributed from Panama and the West Indies to southern Brazil and Paraguay; especially rich in the Amazonian region and Guiana.

a. Stellate scales abundant; monocarps very rugose above the middle .....1. D. PANAMENSIS.
aa. No scales, only stellate hairs; monocarps smooth .....2. D. VALLICOLA.

1. DUGUETIA PANAMENSIS Standl. in Field Mus. Publ. Bot. 4: 207. 1929; R. E. Fries, in Acta Hort. Berg. 12: 53. 1934.

A tree about 10 m. high, the young branchlets densely covered with golden-yellow stellate scales. Leaves on 3-4 mm. long petioles, 12-22 cm. long and 3.5-5.0 cm. broad, chartaceous, glabrous on upper side from the first, densely scaly underneath when young, finally nearly glabrescent, oblanceolate, cuneate and very acute at the base, contracted at the apex into an obtuse acumen 1.5-3.0 cm. long. Inflorescences 1- to 3-flowered, opposite the leaves, shortly pedunculate. Flowers on pedicels 2-4 mm. long, small, fragrant. Sepals about 10 mm. long, ovate, yellow-

scaly outside. Petals oblong, obtuse, rather densely silvery-scaly outside, up to 13 mm. long and 5 mm. broad. Stamens 1 mm. long, the connective-disk glabrous. Ovaries glabrous. Fruit spherical, 3.5-4.5 cm. across; monocarps numerous, free, clavate, 16-18 mm. long and 7-8 mm. thick, very rugose above the middle, rotundate and very shortly apiculate at the apex.

BOCAS DEL TORO: region of Almirante, Daytonia Farm, Jan. 1928, *Cooper 418*.

The appearance of the fruit of this species is unique in its genus. Towards their upper parts, the monocarps are densely covered by protuberant, conical, and acuminate excrescences, about a millimetre long, making their appearance so foreign to the genus that the specimen might easily be taken for a monstrosity (galls ?). Nevertheless, the species is well differentiated from the other Duguetias also by other characters.

2. DUGUETIA VALLICOLA Macbr. in Contr. Gray Herb. n. ser. 56: 51. 1918; R. E. Fries, in Acta Hort. Berg. 12: 85. 1934.

A shrub or tree, up to 20-25 m. high. Leaves on petioles 4-7 mm. long, provided at first with small stellate grayish hairs on the upper side and finally glabrescent, densely stellate-hirsute at first beneath, finally nearly glabrous with scattered hairs, oblong-lanceolate or narrowly elliptic, rather gradually tapering at the apex, narrowed into the rotundate-obtuse or shortly acute base, 15-30 cm. long and 4.5-8.0 cm. broad. Flowers opposite the leaves or below the nodes; pedicels gray-tomentellous, 12-15 mm. long (in fruits up to 25 mm.). Sepals reflexed, ovate, gray-tomentellous on both sides, 8-12 mm. long. Petals ovate, obtuse, longitudinally striate at the base, densely covered on both sides with very short, gray, stellate hairs, up to 2.5 cm. long and 1.5 cm. broad. Stamens 1.3-1.5 mm. long. Fruit 4.0-4.5 cm. diam.; monocarps free, glabrous but more or less pruinose, obovoid, pentagonal, shortly apiculate, up to 18 mm. long and 7-8 mm. across.

DARIÉN: forest around Pinogana, *Pittier 6565*.

Described from Colombia, Magdalena Valley; probably also occurring in Venezuela.

13. ANNONA L.

ANNONA L. Sp. Pl. 536. 1753 *[Anona]*.

Shrubs or trees with simple or stellate hairs. Flowers solitary or in few-flowered inflorescences, terminal or opposite the leaves, or extra-axillary from the internodes. Sepals 3, small, valvate. Petals 6, free or connate at the base, biseriate, or the inner rudimentary or absent, the outer valvate, the inner imbricate or valvate. Stamens numerous, the anther cells not locellate, the connective generally terminating in a swollen head or hoodlike process above the pollen sacs. Carpels numerous or rarely few; ovule 1, basal, erect. Fruit fleshy, formed by the concrescence of the carpels and the torus, usually areolate on the surface, the areoles, indicating the united carpels, being often gibbous or acuminate.

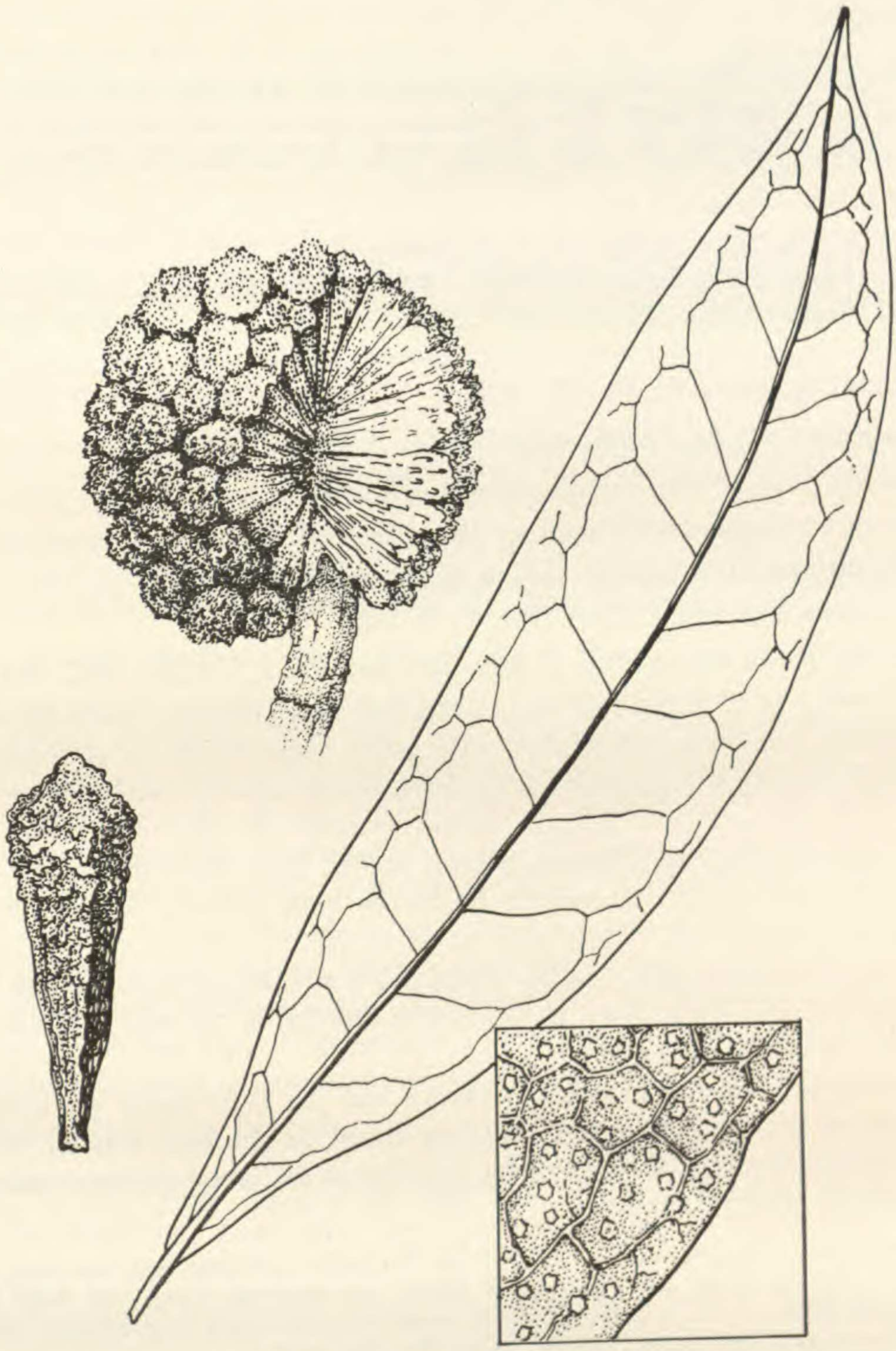

Figure 164. *Duguetia panamensis*

A large genus of about 110 species in all the tropics of America from Florida, Mexico and the West Indies to southern Brazil and Paraguay. A few species also in tropical Africa. Five indigenous species are recorded from Panama.

a. Petals 6.
  b. Petals free.
    c. Branchlets and leaves glabrous; sepals 3-5 mm. long; petals about 3 mm. long, the inner valvate .....1. A. GLABRA.
    cc. Branchlets and leaves hirsute; sepals 1-2 cm. long; outer petals up to 5 cm. long, the inner imbricate .....2. A PURPUREA.
  bb. Petals connate at base .....5. A. HAYESII
aa. Petals 3, the inner missing or very rudimentary.
  b. Leaves thickly tomentose beneath, 10-20 cm. long .....3. A. SPRAGUEI.
  bb. Leaves glabrous, 6-8 cm. long .....4. A. ACUMINATA.

1. ANNONA GLABRA L. Sp. Pl. 537. 1753.

Anona palustris L. Sp. Pl. 757. 1762.

Anona laurifolia Dunal, Monogr. Anonac. 65. 1817.

Anona peruviana Humb. & Bonpl. ex Dunal, l. c. 67. 1817.

Anona uliginosa H. B. K. Nov. Gen. & Sp. Pl. 5: 65. 1821.

Anona australis St. Hil. Fl. Bras. Mer. 1: 33. 1825.

Anona pisonis St. Hil. & Tul. in Ann. Sci. Nat. sér. 2. 17: 131. 1842, non Mart.

A tree up to 10 metres high; branchlets very soon glabrous. Leaves on petioles 1.0-1.5(-2.5) cm. long, rather thin, pale green, ovate-elliptic or oblong-elliptic, rotundate or acute and decurrent at the base, shortly acute or rarely obtuse at the apex, 7-14 cm. long and 3-8 cm. broad; network of veins dense and nicely prominent on both sides. Flowers solitary, issuing from about the middle of the internodes below the leaves; pedicels 1.5-2.0 cm. long, glabrous. Sepals rotundate, apiculate, 3-5 mm. long. Petals glabrous on outside, the outer ovate, 2.5-3.0(-4.0) cm. long, the inner a little smaller. Stamens 3-4 mm. long, connective disk broad, papillose but not setose. Fruit globose-ovoid, rounded at the top, 7-12 cm. long, smooth, areoles hardly obvious.

This species is distributed from Mexico and the West Indies southwards to Ecuador on the west side and to southern Brazil on the east, also on the west coast of tropical Africa; always growing near the sea in littoral forests, in mangrove swamps and on riverbanks.

CANAL ZONE: Chagres, *Fendler 1;* forest at Río Indio de Gatún, near sea-level, *Pittier 2809;* in swampy places near Panamá, *S. Hayes s.n.* BOCAS DEL TORO: Old Bank Island, *Von Wedel 2082.*

Also reported from Barro Colorado Island (Standley, 1933).

2. ANNONA PURPUREA Moc. & Sesse, ex Dunal, Monogr. Anonac. 64, *tab.* 2. 1817.

Anona manirote H. B. K. Nov. Gen. & Sp. Pl. 5: 59. 1821.

Anona involucrata Baill. in Adansonia 8: 265. 1867-68.

Anona prestoei Hemsl. in Hook. Ic. Pl. 4: 6, *t. 2519-20.* 1897.

Tree with ferruginous-tomentose branchlets. Leaves deciduous, on 3-5 mm. long petioles, membranaceous, on the upper side shortly and thinly, on the nerves more densely hirsute, finally more or less glabrate, underneath longer ferruginous-hirsute along the nerves, obovate or elliptic-obovate, rotundate at the base, shortly acuminate at the apex, 12-30 cm. long and 6-14 cm. broad. Flowers solitary, subsessile; flower bud enclosed at first by an involucre composed of 2 sessile acuminate bracts. Calyx lobes triangular-ovate, acuminate, 1-2 cm. long. Outer petals valvate, thick, rigid, ovate-lanceolate, gradually tapering into a long, obtuse apex, up to 5 cm. long and 2 cm. broad, ferruginous-sericeous on the outside, inner petals imbricate, thinner, elliptic-oblong, rotundate at the apex, 2.5 cm. long. Stamens 5-6 mm. long. Fruit globose, up to 20 cm. in diameter, bearing numerous pyramidal protuberances and clothed with brown felt-like tomentum. Seeds 28-30 cm. long.

This species is recorded from Mexico, British Honduras, Costa Rica, Panama, Venezuela, Ecuador and Trinidad.

CANAL ZONE: Ancón Hill, alt. 200 ft. *Allen 4521;* Hospital grounds, Ancón, *Pittier 3955;* Barro Colorado Island, *Bangham 610;* Matachín, on Panamá Railway, *Hayes s.n.* CHIRIQUÍ: forest of San Félix, *Pittier, 5749;* Chiriquí, *Cooper & Slater P 314.*

The species "is common on the Pacific slope" (Standley, 1928, p. 180).

3. ANNONA SPRAGUEI Saff. in Contr. U. S. Nat. Herb. 16: 270, *fig. 43, pl. 92-93* 1913.

Anona uncinata Sprague, in Bull. Herb. Boiss. sér. 2. 5: 701. 1905, non Lam.

A tree up to 16 m. high; young branchlets ferruginous-tomentose, soon glabrescent. Leaves on petioles 8-15 mm. long, membranaceous, pellucid-punctulate, sparsely pubescent above, at first very densely and softly sericeous-pubescent beneath with appressed grayish olivaceous hairs, rufous-tomentose along the midrib and lateral nerves, lanceolate to oblanceolate or narrowly elliptic, shortly acute or sometimes subrotundate at the base, acuminate at the apex, 15-35 cm. long and 5-11 cm. broad. Flowers solitary; pedicels about 1 cm. long, in fruit up to 2 cm. long (or longer ?); flower buds globose. Sepals long-caudate from an ovate base, 8-10 mm. long. Petals thick, rotundate-ovate, 18-25 mm. long, tomentellous on the outside. Stamens 3.0-3.5 mm. long. Fruit globose or globose-ovoid, about 5 cm. in diameter; the areoles produced into long-attenuate protuberances. Seeds oblong, 7-9 mm. long.

Known only from Panamá.

CANAL ZONE: Gamboa, *Pittier 3409;* R. Cocoli, opposite lighthouse, *P. White 99;* Frijoles, *Standley 27570.* PANAMÁ: San José Island, Perlas Archipelago, *Johnston 734;* Barbacoas, *Hayes 127;* Tapía River, Juan Díaz region, *Maxon & Harvey 6649.* DARIÉN: Marraganti and vicinity, Río Tuyra, 10-200 ft. elev., *Williams;* forest around Yaviza, *Pittier 6540.*

Also reported from Barro Colorado Island (Standley 1933).

4. ANNONA ACUMINATA Staff. in Contr. U. S. Nat. Herb. 16: 274. *pl. 97.* 1913.

Anona echinata Hemsl. Biol. Centr.-Amer. Bot. 1: 19. 1879, non Dunal.

Tree, 5-7 m. high; young branchlets clothed with very minute appressed hairs, soon glabrate. Leaves on petioles 3-5 mm. long, membranaceous, finally glabrous, pellucid-punctulate, lanceolate or oblong-elliptical, acute and decurrent at the base

Figure 165. *Annona acuminata*

and gradually acuminate at the apex, 5-9 cm. long and 1.5-2.5 cm. broad. Flowers solitary, more or less opposite the leaves; pedicels 12-16 mm. long, with 2 linear-lanceolate bracts 2-4 mm. long; flower buds subglobose, about 15 mm. in diameter. Sepals high-connate, appressed-pilose on the outside. Petals 3, ovate-rotundate, connate at the base, 12-15 mm. long and broad. Stamens 2.5 mm. long; connective disk muriculate with short stiff points. Fruit globose, 2.0-2.5 cm. in diameter, with conical spines 1 mm. long. Seeds yellow, 7-8 mm. long.

Recorded only from Panamá.

CANAL ZONE: vicinity of Salamanca Hydrographic Station, Río Pequení, alt. ca. 80 m., *Woodson, Allen & Seibert 1564;* drowned forest of Quebrada Tranquilla and its branches, *Dodge & Allen 17331;* Bohío station, Panamá railroad, *Hayes 142.* PANAMÁ: Río Tapía, *Standley 26212, 28036.*

Reported from Barro Colorado Island (Standley 1933).

5. ANNONA HAYESII Saff. ex Standley, in Journ. Washington Acad. Sci. 15: 102. 1925; R. E. Fries, in Acta Hort. Berg. 10: 273, *tab. 21.* 1931.

A high shrub or small tree; branchlets densely sericeous-tomentose, ferruginous. Leaves on petioles 3-7 mm. long, thin-membranaceous, underneath pale and at first appressed-hirsute, soon glabrous except on the nerves, obovate or elliptic, abruptly acuminate and rather rotundate at the base, 8-12(-25) cm. long and 4-9 cm. broad. Inflorescences opposite the leaves or produced from the middle of the internodes below the leaves, 1- or few-flowered; pedicels 12-15 mm. long, densely ferruginous-hirsute; flower buds long-caudate from a globose base. Sepals ovate, acuminate. Outer petals up to 30 mm, long, connate up to 5 mm. above the base, the base ovate, abruptly narrowed into a linear obtuse acumen nearly 20 mm. long, rufous sericeous-tomentellous on the outside; inner petals minute, 5-7 mm. long, connate with the outer at the base. Stamens 1.2-15 mm. long, the connective disk narrower than the anther. Fruit subglobose, smooth, 5 cm. long or more.

Found only in Panama.

CANAL ZONE: Ancón Hill, alt. 200 ft., *Allen 4521;* Corozal, *Gervais 141.* DARIÉN: forest at Yaviza, *Pittier 6592;* La Palma, alt. 50 m., *Pittier 6598.* PANAMÁ: thickets and forests near Arraiján, alt. ca. 15 m., *Woodson, Allen & Seibert 1372;* Matías Hernández, *Pittier 6749.*

Also reported from Barro Colorado Island (Standley, 1933).

14. ROLLINIA St. Hil.

ROLLINIA St. Hil. Fl. Bras. Merid. 1: 28, *t.* 5. 1825; R. E. Fries, in Acta Hort. Berg. 12: 112. 1934.

Trees and shrubs. Flowers usually clustered in inflorescences opposite the leaves, or extra-axillary from the internodes. Sepals small, valvate. Petals valvate, connate at the base, the outer produced on their outside into a wing or spur. Stamens numerous, their anther cells not locellate; connective expanded above the anther into a truncate disk. Carpels several to numerous, united into a fleshy syncarpium; ovule solitary, basal, erect.

A large genus of about 62 species, distrubuted from Central America and the West Indies to southern Brazil, Paraguay and northern Argentina. Only 3 species are recorded from Panama.

a. Sepals thin, flat, not keeled; petal wings spreading and curved upward a little ..... 1. R. PERMENSIS.

aa. Sepals more or less concave, the midrib thickened and keeled on the outside.

b. Sepals about 3 mm. long; petal wings recurved ..... 2. R. PITTIERI

bb. Sepals very small, 1.0-1.5 mm. long; petal wings spreading but not recurved ..... 3. R. MICROSEPALA

Rollinia chocoënsis R. E. Fr., which, according to E. P. Killip, occurs "along the Pacific coast of Colombia from the Darién region of Panama into northern Ecuador" (cf. R. E. Fries in Sv. Vet.-Akad. Handl., ser. 3, 24[10]: 18. 1948), might possibly be added to the above. As, however, no specimen from Panama has been available and as it is hard to distinguish it from closely related species, it is perhaps better for the time being not to include it in the flora of that country.

1. Rollinia permensis Standl. in Field Mus. Publ. Bot 4: 208. 1929.

A small tree about 6 m. high; young branchlets, petioles and flower-pedicels covered with ferruginous appressed to patent hairs. Leaves membranaceous, 20-30 cm. long and 8-13 cm. broad, obovate or elliptic-obovate, cuneate or shortly rotundate-acute at the base, 2-3 cm. long, cuspidate at the apex; upper side thinly hairy when young, soon glabrescent, with persistent hairs on the impressed midrib and thicker nerves, densely hairy underneath, finally nearly glabrescent, the midrib with short appressed glossy hairs. Inflorescences more or less opposite the leaves on peduncles about 3 mm. long, bearing up to 8 flowers; pedicels up to 2.5 cm. long. Sepals rotundate-ovate, ferruginous-sericeous, 3-4 mm. long. Corolla 2.0-2.5 cm. across, tomentellous, gray at the base, more densely ferruginous upward; wings divergent and curved upwards a little, oblong, about 10 mm. long and 5 mm. broad.

Chiriquí: *Cooper & Slater 211*. San Blas: Permé, *Cooper 645*.

2. Rollinia pittieri Saff. in Journ. Washington Acad. Sci. 6: 376. 1916.

Tree with the young branchlets very shortly sericeous. Leaves on petioles 7-12 mm. long, membranaceous, 8-20 cm. long and 4.5-8.5 cm. broad, elliptic or obovate-elliptic, shortly rotundate-acute at the base, abruptly contracted at the apex into a cusp about 1 cm. long, nearly glabrescent above, glaucous beneath, the nerves cinnamomeous and rather densely covered with short appressed white hairs. Inflorescences sessile, opposite the leaves or issuing a little below the nodes; flowers up to 6, on pedicels 3.5(-5.0) cm. long. Sepals triangular, 2-3 mm. long, the midrib thickened and keeled on the outside. Corolla 2.5-3.0 cm. across; wings very densely and shortly silvery-tomentellous, obviously recurved, 1.0-1.5 cm. long and 0.7-1.0 cm. broad. (Fruits unknown).

San Blas: plain of Sperdi, near Puerto Obaldía, near sea level, *Pittier 4358*.

3. Rollinia microsepala Standl. in Field. Mus. Publ. Bot. 4: 208. 1929.

Young branchlets fulvous-sericeous, the hairs short-appressed. Leaves on petioles 6-10 mm. long, 10-18 cm. long and 3.5-5.0 cm. broad, oblong or lanceolate-oblong, gradually narrowed at the apex, acute or rotundate at the base, glabrous above and shortly sericeous beneath. Inflorescences about 3-flowered, opposite the leaves or produced a little below the nodes; pedicels densely sericeous, 15-18 mm. long. Sepals minute (1.3-1.8 mm. long), curvate, concave, sericeous. Corolla gray, tomentellous; petal wings cuneate or narrowly obovate, broadly rotundate at the

apex, spreading but not recurved, 15-18 mm. long and 8-10 mm. broad. Stamens 0.6 mm. long. Fruit globose, rather smooth and very shortly tomentellous, 15-17 mm. diam.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 9, 102.*
This species is also recorded from Costa Rica: San Carlos, *Kotschny.*

Figure 166. *Rollinia permensis*

MYRISTICACEAE

By J. A. DUKE

Aromatic trees or shrubs, not infrequently with buttressed bases, whorled branches, stellate pubescence, and reddish sap. Leaves alternate, exstipulate, penninerved, entire, often coriaceous, occasionally with pellucid punctation or stellate pubescence. Flowers unisexual, usually dioecious, actinomorphic, basically trimerous, solitary or more usually fascicled in racemes or panicles, or in dichotomous cymes. Perianth uniseriate, of typically 3 partially fused carnose tepals. Stamens 2-30, the filaments united into a column, the 2-locular extrorse anthers free or coherent to the column. Pistillodes absent. Ovary superior, 1-carpellate, the stigma subsessile; with a single basal anatropous ovule. Fruit fleshy, the thick pericarp splitting longitudinally into 2 valves, the seed often with a reddish laciniate aril, the endosperm ruminate.

A tropical group of about 15 genera centered in America, Africa and Asia, this family is represented in the Americas by 6 genera, 1 of them including the nutmeg of commerce *Myristica fragrans*, locally introduced. Little can be added to the excellent monograph of the American representatives by A. C. Smith (in Brittonia 2: 393. 1937). Four of the 6 American genera occur in Panama.

a. Leaves and young twigs glabrous; secondary veins 4-12 pairs, the tertiary veins sometimes conspicuously parallel, almost perpendicular to the midrib; anthers 4-30, at least as long as the column.

b. Tertiary veins not conspicuously perpendicular to the midrib; staminate flowers few in dichotomously branching cymes, the perianth 3-7 mm. long; anthers 12-30; pistillate pedicels 6-20 mm. long; arils laciniate .....1. Myristica

bb. Tertiary veins strikingly perpendicular to the midrib; staminate flowers several, fasciculate in subspicate racemes, the perianth 1.5-3.0 mm. long; anthers 4-8; pistillate pedicels 2-4 mm. long; arils subentire .....2. Compsoneura

aa. Leaves and young twigs pubescent, occasionally glabrate; secondary veins 5-35 pairs, the tertiary veins not conspicuously perpendicular to the midrib; anthers 3 (-2-6), longer or shorter than the column.

c. Hairs of the young branchlets and petioles with only 1 or 2 conspicuous branches; secondary veins 5-25 pairs; staminate fascicles subcorymbosely to spicately disposed, the anthers usually free to their bases, rarely connate dorsally .....3. Dialyanthera

cc. Hairs of the young branchlets and petioles with several conspicuous branches; secondary veins 10-35 pairs; staminate fasicles racemosely or paniculately disposed, the anthers dorsally connate or distally divergent, never free to their bases .....4. Virola

1. MYRISTICA Boehm.

Myristica [L.]Boehm. in Ludw. Def. 3: 513. 1760, nom. conserv.

Comacum Adans. Fam. 2: 345. 1763, nom. rejic.

Aromatic, glabrous, dioecious trees, the bases occasionally buttressed. Leaves alternate, subdistichous, glabrous, subcoriaceous, petiolate, exstipulate, the tertiary veins obscure. Flowers rather large for the family, the bracteate pedicels glabrous.

Staminate flowers 1-20 in dichotomously branching cymes; tepals partially connate, usually 3, the anthers 12-30, usually longer than the column. Pistillate flowers commonly solitary, the tepals partly connate, the 1-carpellate ovary with a subsessile 2-lobed stigma. Fruits fleshy, the thick pericarp dehiscing longitudinally into 2 valves; aril usually brightly colored and laciniate; seed ellipsoid to globose.

Of this austral Asian genus of around 75 species, only the commonly cultivated nutmeg, a native of the Moluccas, is found in Panama.

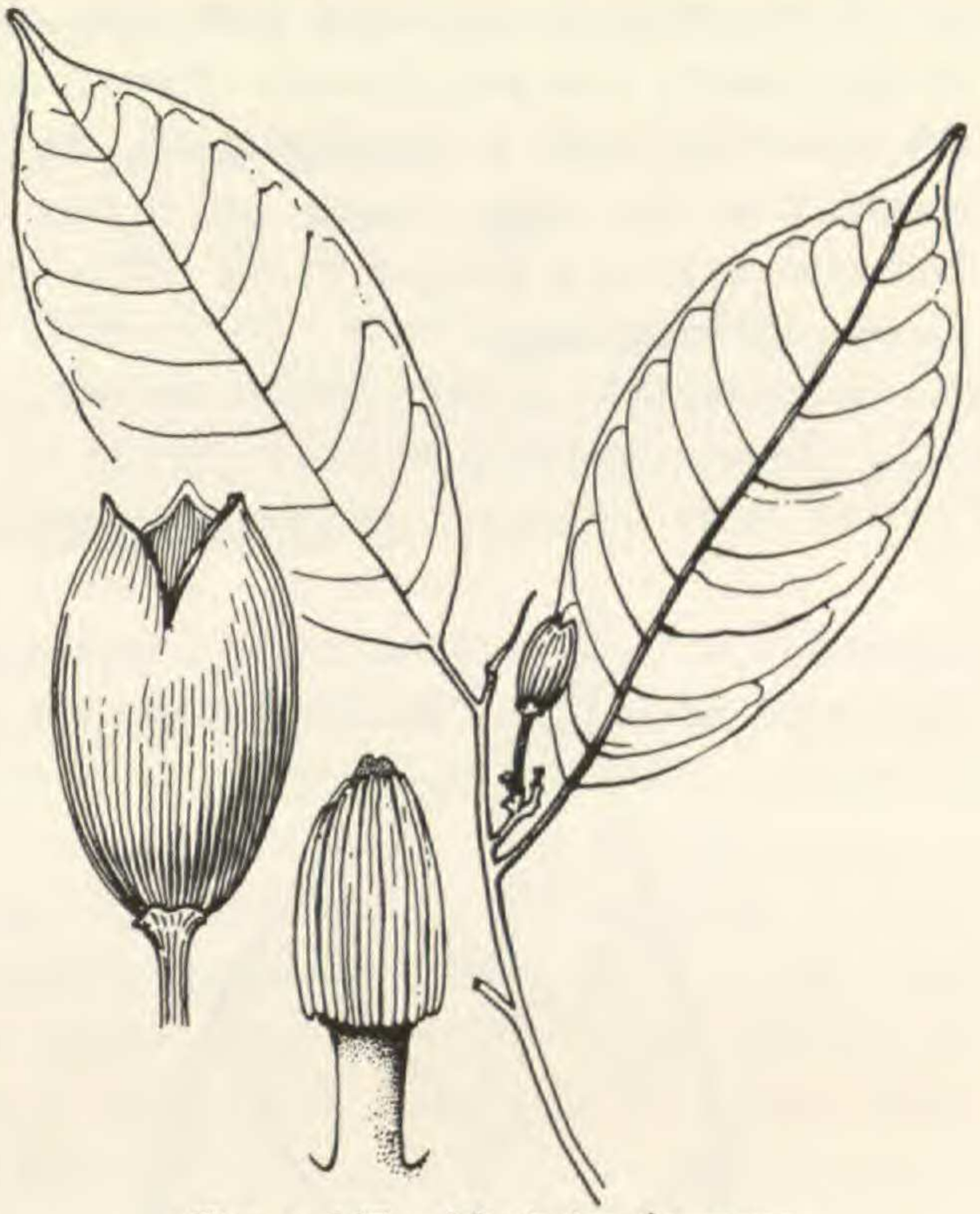

Figure 167. *Myristica fragrans*

1. MYRISTICA FRAGRANS Houtt. Handleid. Hist. Nat. Linn. 2: 333. 1774.
Myristica officinalis L.f. Suppl. 262. 1781.
Myristica moschata Thunb. in Vet. Akad. Handl. Stockh. 49. 1782.
Myristica aromatica Lam. Act. Acad. Sci. Paris 1788: 155. 1791.

Aromatic, dioecious, glabrate trees to 20 m. high, the older bark rather smooth and olivaceous, mottled with white, the younger branches often mottled with red. Leaves subcoriaceous, glabrous, lanceolate to ovate or obovate, apically acute to acuminate, basally acute, 6-12 cm. long, 3-6 cm. broad, with usually 6-11 pairs of secondary veins, the tertiary nerves obscure, not conspicuously perpendicular to the midrib, the petioles 5-15 mm. long, ca. 1 mm. broad. Staminate flowers 1 to few in dichotomous cymes; pedicels glabrous, 5-15 mm. long; bracts ca. 1 mm. long; perianth tardily 3-parted, 3-7 mm. long; anthers 12-30, 2-3 mm. long, dorsally coherent to the column, the infra-antheral portion of the column 1-2 mm. long. Pistillate flowers solitary or rarely paired in the axils; pedicels glabrous, 5-15 mm. long; bracts ca. 1 mm. long; perianth accrescent, tardily 3-parted, the segments deltoid, the subsessile stigma obscurely 2-lobed. Fruit fleshy, ovoid to pyriform, the pericarp splitting longitudinally into 2 valves, 3-6 cm. long, 2.5-4.5 cm. broad; seed 1.5-4.5 cm. long, 1.0-2.5 cm. broad, the laciniate aril reddish.

Native to the Moluccas, widely cultivated in tropical America.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel 1232*.

Many spices are extracted from this utilitarian tree, now largely cultivated in southeastern Asia and Grenada. Mace is derived from the aril, and nutmeg from the pulverized seed; a non-drying oil, the so-called nutmeg butter, is also expressed from the seeds. Rumor has it that imperial bureaucrats of little botanic bent once ordered a speedup in the culture of nutmeg trees and a cutback in production for mace trees.

2. COMPSONEURA Warb.

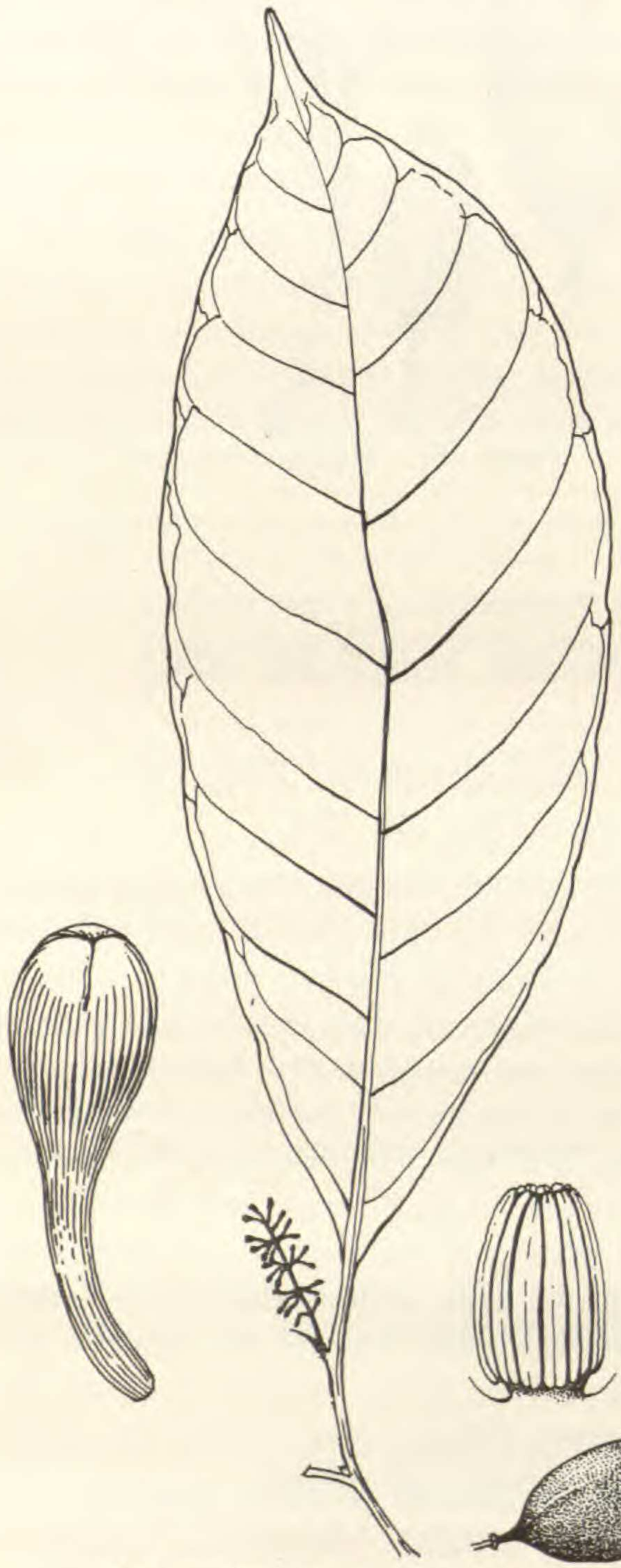

Figure 168. *Compsoneura sprucei*

Compsoneura Warb. in Ber. Deutsch. Bot. Ges. 13: 83, 1895, hyponym; in Nov. Act. Acad. Leop.-Carol. 68: 125. 1897.

Dioecious glabrous shrubs or trees, the sap often reddish. Leaves alternate, glabrous, chartaceous to coriaceous, petiolate, exstipulate, the tertiary veins parallel, conspicuously perpendicular to the midrib. Flower fascicles in spikes, racemes or panicles, the axes glabrous, the bracts absent or inconspicuous. Staminate flowers 3-25 per fascicle, the 3 (-5) tepals partially united; anthers 4-10, as long as or longer than the column. Pistillate flowers 1-8 per fascicle, the tepals partly connate, the 1-carpellate ovary with a subsessile 2-lobed stigma. Fruits fleshy, the thin pericarp dehiscing longitudinally into 2 valves; aril usually brightly colored and subentire; seed ellipsoid.

In this genus of 8 species, that which occurs in Panama essentially covers the entire range of the genus, from southern Mexico through Central America to Amazonian Peru and Brazil.

1. COMPSONEURA SPRUCEI (A. DC.) Warb. in Nov. Act. Acad. Leop.-Carol. 68: 143. 1897.

Myristica sprucei A. DC. in DC. Prodr. 14: 199. 1856.

Myristica mexicana Hemsl. Biol. Centr.-Am. Bot. 3: 67. 1882.

Compsoneura costaricensis Warb. in Fedde, Repert. Sp. Nov. 1: 71. 1905.

Glabrate shrubs or trees to 13 m., the sap reddish. Leaves chartaceous or subcoriaceous, glabrous, oblong to obovate, apically acute to acuminate, basally attenuate to rounded, 9-30 cm. long, 3.5-10.0 cm. broad; secondary veins (4-)6-10 (-12) on either side; tertiary veins parallel, conspicuously perpendicular to the midrib; petioles 7-30 mm. long, 1-3 mm. broad. Staminate fascicles 3- to 15-flowered, in subspicate racemes (in Panama), the racemes 1-5 per axil, 2-8 cm. long; pedicels 0.5-2.0 mm. long, perianth tardily 3(-4) parted, 1.5-3.0 mm. long, anthers 4-8, 1.0-1.5 mm. long, free or somewhat connate basally, the infra-antheral portion of the column less than 0.5 mm. long. Pistillate fascicles 2-8 cm. long, 1- to 8-flowered; pedicels 2-4 mm. long; perianth accrescent, tardily 3(-4) parted; ovary subglobose, with a subsessile 2-lobed stigma. Fruit somewhat fleshy, ellipsoid, the perianth splitting longitudinally into 2 valves, 20-37 mm. long, 13-21 mm. broad, the reddish aril entire except at the tip.

Southern Mexico to Amazonian Peru and Brazil, at low elevations.

BOCAS DEL TORO: Water Valley, vicinity of Chiriquí Lagoon, *Von Wedel 598, 946, 1717;* vicinity of Chiriquí Lagoon, *Von Wedel 1004, 2382, 2462;* Daytonia Farm, region of Almirante, *Cooper 420;* Changuinola Valley, *Cooper & Slater 84.* COLÓN: Loma de la Gloria, near Fató (Nombre de Dios), 10-104 m., *Pittier 4099, 3846.* SAN BLAS: Permé, *Cooper 241.*

Dr. A. C. Smith observes (in Brittonia 2: 411. 1937) that the Central American material varies from the Amazonian material in having the fascicles subsessile on the rhachis, but he concludes that the variation is of no taxonomic consequence.

3. DIALYANTHERA Warb.

DIALYANTHERA Warb. in Ber. Deutsch. Bot. Ges. 13: 83. 1895, hyponym; in Nov. Act. Acad. Leop.-Carol. 68: 126. 1897.

Dioecious trees often with reddish sap, the younger branchlets pubescent. Leaves alternate, glabrous above, strigillose below with 2- to few-branched hairs, chartaceous or subcoriaceous, petiolate, exstipulate, the tertiary veins obscure. Staminate fascicles in subspicate racemes or subcorymbose, the axes pubescent with few-branched hairs; bracts and bracteoles inconspicuous or absent; flowers 2-40 per fascicle, the perianth deeply but tardily 3(-4)-parted; anthers 2-6, usually free to the base, shorter or longer than the column. Pistillate flowers 2-5 per fascicle, the tepals partially connate; ovary 1-carpellate with a subsessile obscurely 2-cleft stigma. Fruits 1-4 per inflorescence, the ligneous pericarp dehiscing longitudinally into 2 valves; seed ellipsoid to globose, the aril laciniate.

A genus of six species, ranging from Costa Rica through Central America to Amazonian Peru and adjacent Brazil.

a. Petioles winged to the base, 6-14 mm. broad; secondary veins 20-35 on either side; staminate pedicels 5-10 mm. long ..... 1. D. LATIALATA.

aa. Petioles narrowly if at all winged, 1-6 mm. broad; secondary veins 5-18 on either side; staminate pedicels 1-6 mm. long.

b. Leaves 10-28 cm. long, 4-16 cm. broad, the secondary veins 8-18 on either side; staminate inflorescences subspicate, 3-15 mm. long, the perianth 3.0-4.5 mm. long; androecium 2.4-3.0 mm. long, the anthers attached dorsally at the base ..... 2. D. OTOBA.

bb. Leaves 5-15 cm. long, 2.5-6.0 cm. broad, the secondary veins 5-10 on either side; staminate inflorescences subcorymbose, 1.0-2.5 cm. long, the perianth 1.5-3.0 mm. long; androecium 1.7-2.1 mm. long, the anthers attached dorsally near the middle ..... 3. D. ACUMINATA.

1. DIALYANTHERA LATIALATA Pittier, in Contr. U. S. Nat. Herb. 20: 454, 1922.

Dioecious trees to 20 m., the younger branchlets strigillose, glabrescent. Leaves rugulose, minutely strigillose below, elliptic or obovate-elliptic, apically cuspidate or short-acuminate, basally attenuate, 20-40 cm. long, 7-13 cm. broad; secondary veins 20-25 on either side, the tertiary veins obscure; petioles winged, 15-40 mm. long, 6-14 mm. broad. Staminate fascicles in subspicate racemes, the racemes 1-3 per axil, 10-16 cm. long; fascicles 10- to 40-flowered, the pedicels 5-10 mm. long; perianth tardily 3-parted, 2.5-3.5 mm. long; bracts deciduous; anthers 2-3, ca. 0.25 mm. long, free to their bases, the infra-antheral portion of the androecium ca. 1.5 mm. long. Fruits 2-few per inflorescence, the rugulose ligneous pericarp ultimately splitting longitudinally into 2 valves, compressed-subglobose, short-stipitate, ca. 25 mm. long, 18 mm. broad; seed compressed-subglobose, the aril subentire.

Panama to Colombia, at very low elevations.

CANAL ZONE: forest between Peluca Hydrographic Station and Quebrada Peluca, along R. Boquerón, ca. 70 m., *Steyermark & Allen 17227*. COLÓN: along R. Fató, 10-100 m., *Pittier 4193*.

2. DIALYANTHERA OTOBA (Humb. & Bonpl.) Warb. in Ber. Deutsch. Bot. Ges. 13. 89. 1895.

Myristica otoba Humb. & Bonpl. in Willd. Sp. Pl. 4: 869. 1805.

Dioecious trees to 30 m., the younger branchlets rugulose, strigillose, glabrescent. Leaves verruculose, strigillose but glabrescent below, broadly elliptic to obovate, 10-28 cm. long, 4-16 cm. broad; secondary veins 8-18 on either side, the tertiary veins very obscure; petioles canaliculate, slightly winged, 15-40 mm. long, 1-6 mm. broad. Staminate fascicles in subspicate racemes, 1-3 racemes per axil, 3-16 cm. long; fascicles 2-12, 8- to 15-flowered; pedicels 1-6 mm. long, the fugaceous orbicular bracts 3-4 mm. long; perianth tardily 3-parted, 3.0-4.5 mm. long; anthers 0.5-0.8 mm. long, free to their bases or slightly connate dorsally, the infra-antheral portion of the androecium 1.5-2.5 mm. long. Pistillate flowers 2-5 per fascicle, the perianth 3-lobed nearly to the base, to 5 mm. long; ovary 1-carpellate, with an obscurely 2-lobed stigma on a short curving style. Fruits 2-4 per inflorescence, the verrucose ligneous pericarp dehiscing longitudinally into 2 valves, subglobose to ellipsoid, 21-33 mm. long, 16-23 mm. broad; seed ellipsoid to subglobose, the aril laciniate.

Figure 169. *Dialyanthera latialata*

Costa Rica to Colombia, usually below 1000 m.

BOCAS DEL TORO: vicinity of Guabito, *Stern & Chambers 112;* loc. indet., *Von Wedel 440;* region of Almirante, *Cooper & Slater 7.* CHIRIQUÍ: Progreso, *Cooper & Slater 257* & *451.*

Called *saba, bogamani verde, roble, miguelario,* "wine wood" and "white cedar" in Panama, *fruta dorado* and *sebo* in Costa Rica, and *otoba* in Colombia, this rather large tree has somewhat foul-smelling fruits reputedly used as is the nutmeg. Locally, the wood is utilized in carpentry.

3. DIALYANTHERA ACUMINATA Standl. in Field Mus. Publ. Bot. 4: 209. 1929.

Dioecious trees to 20 m., the younger branchlets strigose, glabrescent. Leaves verrucose, strigillose and glabrescent below, ovate to elliptic, apically acuminate, basally acute or attenuate, 5-15 cm. long, 2.5-6.0 cm. broad; secondary veins 5-10 on either side, the tertiary veins very obscure; petioles canaliculate, 8-20 mm. long, 1-2 mm. broad. Staminate fascicles subcorymbosely disposed, 1-3 "corymbs" per axil, 1.0-2.5 cm. long; fascicles 1-3, 3- to 10-flowered, the pedicels 1-4 mm. long; perianth 1.5-3.0 mm. long, tardily 3- to 4-parted, the bracts to 1 mm. long; anthers 0.25-0.5 mm. long, attached dorsally near the middle, the infra-antheral portion of the androecium ca. 1.5 mm. long. Pistillate and fruiting inflorescences not seen.

Known only from Panama where it is called *saba.*

BOCAS DEL TORO: Daytonia Farm, region of Almirante, *Cooper* 395. COCLÉ: vicinity of El Valle de Antón, ca. 600 m., *Allen 2004;* region north of El Valle de Antón, 1000 m., *Allen 3645.*

4. VIROLA Aubl.

VIROLA Aubl. Pl. Guian. Fr. 2: 904. 1775.

Sebophora Neck. Elem. 2: 188. 1790.

Dioecious shrubs or trees, the younger portions usually pubescent with stellate hairs, the sap often reddish or brownish. Leaves alternate, glabrous above, stellate-pubescent and often glabrescent below, submembranaceous to coriaceous, petiolate, exstipulate, the tertiary veins obscure. Flowers in fascicles, racemes or panicles, the axes usually stellate-pubescent; bracts membranaceous, deciduous; bracteoles absent. Staminate flowers in fascicles of 3-15, the perianth deeply or shallowly 3- to 4-parted; anthers 2-6, dorsally connate, at least basally, longer or shorter than the column. Pistillate flowers solitary or in fascicles of 2-7, the tepals partially connate. Fruits 1-40 per inflorescence, the ligneous pericarp dehiscing longitudinally into 2 valves; seed globose to ellipsoid, the aril laciniate.

The largest American genus, this has 38 species concentrated largely in the Amazon basin. Five of the six Central American species occur in Panama, the sixth being thus far reported only from British Honduras.

a. Hairs of lower leaf surfaces stalked, persistent.
   b. Secondary veins of leaves 10-28 on either side, averaging less than 1 per cm. along the midrib; staminate inflorescences much branched; mature fruits 10-30 per inflorescence, the pericarp 0.5-2.0 mm. thick .....1. V. SEBIFERA.
   bb. Secondary veins of leaves 18-35 on either side, averaging more that 1 per cm. along the midrib; staminate inflorescences 1- or 2-branched; mature fruits 1-5 per inflorescence, the pericarp 2-3 mm. thick .....2. V. KOSCHNYI.

aa. Hairs of the lower leaf surfaces sessile, usually evanescent.

c. Secondary veins of leaves 25-30 on either side, averaging 1.5-2.5 per cm. along the midrib; bracts of the staminate inflorescences 3-5 mm. long; fruits short-stipitate, 3-8 per inflorescence, on pedicels 6-9 mm. long
3. V. NOBILIS.

cc. Secondary veins of leaves 9-21 on either side, averaging 0.8-1.3 per cm. along the midrib; bracts of the staminate inflorescences 2-3 mm. long; fruits sessile.

d. Pedicels of the staminate flowers 0.5-1.5 mm. long, subtended by a conspicuous discoid expansion of the ultimate peduncle; fruits 1-5 per inflorescence, more than 2 cm. long, the pedicels 5-10 long
4. V. GUATEMALENSIS.

dd. Pedicels of the staminate flowers 2-3 cm. long, the subtending peduncle not conspicuously flared in the form of a disk; fruits 5-40 per inflorescence, less than 2 cm. long, the pedicels 2-5 mm. long
5. V. ELONGATA.

1. VIROLA SEBIFERA Aubl. Pl. Guian. Fr. 2: 904. 1775.

Myristica sebifera Sw. Prodr. 96. 1788.
Myristica virola Raeusch. Nom. ed. 3. 292. 1797.
Myristica sebifera var. *cordifolia* A. DC. in DC. Prodr. 14: 195. 1856.
Myristica sebifera var. *curvinervia* A. DC. loc. cit. 1856.
Myristica mocoa A. DC. loc. cit. 1856.
Myristica panamensis Hemsl. Biol. Centr.-Am. Bot. 3: 67. 1882.
Virola sebifera var. *curvinervia* Warb. in Nov. Act. Acad. Leop.-Carol. 68: 174. 1897.
Virola venezuelensis Warb. loc. cit. 182. 1897.
Virola mocoa (A. DC.) Warb. loc. cit., 183. 1897.
Virola boliviensis Warb. loc. cit. 184. 1897.
Virola panamensis (Hemsl.) Warb. loc. cit. 185. 1897.
Virola peruviana var. *tomentosa* Warb. loc. cit. 189. 1897.
Virola mycetis Pulle, in Rec. Trav. Bot. Néerl. 4: 125. 1907. in part.
Virola warburgii Pittier, in Contr. U. S. Nat. Herb. 18: 143. 1916.

Dioecious, often buttressed trees to 40 m., the younger branchlets persistently tomentose or glabrescent. Leaf blades glabrous above, with persistent, ochraceous stalked-stellate hairs below, coriaceous, oblong to elliptic-ovate or obovate, acute to acuminate, cordate, truncate or acute, 10-47 cm. long, 4-15 cm. broad; secondary veins 10-28 per side, averaging less than 1 per cm. along the midrib, the tertiary veins rather prominent below; petioles canaliculate, 8-25 mm. long, 2-5 mm. broad. Staminate flowers in much-branched panicles; pedicels 0-3 mm. long; bracts inconspicuous or absent; perianth tardily 3(-5)-lobed, 1.3-3.0 mm. long; anthers 3(-5), 0.7-1.5 mm. long, usually connate to the apex, the infra-antheral portion of the androecium 0.2-1.0 mm. long. Pistillate flowers solitary or clustered in racemes 3-7 cm. long, 2-7 cm. broad; pedicels 1-4 mm. long; tepals partially connate, with subpinnate ochraceous pubescence; ovary 1-carpellate, with a sessile, obscurely 2-lobed stigma. Fruits 10-30 per inflorescence, the velutinous ligneous pericarp ultimately dehiscing longitudinally into 2 valves, subglobose to ellipsoid, 10-21 mm. long, 7-17 mm. broad; seed ellipsoid to subglobose, the aril laciniate.

Nicaragua to southern Brazil, Bolivia and Peru, usually below 1500 m.

BOCAS DEL TORO: region of Almirante, *Cooper 648.* CANAL ZONE: Barro Colorado Island, Barbour Point to next point south, *Bangham 493,* Barro Colorado Island, *Dwyer 1440;* Barro Colorado Island, *Ebinger 300, Kenoyer 361, 493;* Barro Colorado Island, Gatún Lake, *Standley 31287, 31440, 41091;* road along R. Pina-R. Media divide, *Johnston 1601, 1602.* CHIRIQUÍ: Comarca del Barú, area w. of Puerto Armuelles, 100 ft., *Stern & Chambers 128;* vicinity of San Félix, 0-120 m., *Pittier 5255.* DARIÉN: shores of Bahía de Piñas, *Stern & Chambers 194;* vicinity of Campamento Buena Vista, R. Chucunaque, above confluence with R. Tuquesa, *Stern, Chambers et al 881;* vicinity of Cana, 1750 ft., *Stern, Chambers et al 512;* vicinity of La Palma, 0-50 m., *Pittier 6615.* PANAMÁ: Cerro Azul, *Dwyer 1383;* forest along R. Chagres above Alhajuela, *Pittier 3505;* Juan Díaz, *Standley 30615;* R. Tecumen, *Standley 29373;* R. Tapía, *Standley 28249.*

Colloquial names reported in Panama are *malagueta de montana, mancha, bogamani* and *fruta dorado.*

Stern & Chambers 194 and *Kenoyer 361* approach *V. guatemalensis* in that the subsessile stellate hairs are rather fugaceous, but A. C. Smith (in Brittonia 2: 468. 1937) reveals that Central American specimens of *V. sebifera* deviate from Amazonian specimens in having larger fruits and more pronounced tendencies towards glabrescence and acute rather than cordate leaf bases. Warburg (in Nov. Act. Acad. Leop.-Carol. 68: 171. 1897) explains that many of the economic uses attributed to this species may be due to confusion with other members of the family.

2. VIROLA KOSCHNYI Warb. in Fedde, Repert. Sp. Nov. 1: 71. 1905.

Virola merendonis Pittier, in Contr. U. S. Nat. Herb. 20: 453. 1992.

Dioecious trees to 40 m., the younger branchlets densely tomentose to hirsute with ochraceous, usually evanescent hairs. Leaves glabrescent above except for the midrib, with persistent, ochraceous, stalked-stellate hairs below, coriaceous, oblong to narrowly ovate or obovate, apically acuminate or attenuate, basally cordate to acute, 13-38 cm. long, 4-13 cm. broad; secondary veins 18-35 on either side, averaging more than 1 per cm. along the midrib, the tertiary veins rather prominent below; petioles canaliculate, 7-16 mm. long, 1.5-4.0 mm. broad. Staminate flowers in few-branched panicles, the pedicels 1-5 mm. long; bracts ca. 5 mm. long, deciduous; perianth tardily 3-parted, 1.5-3.0 mm. long; anthers 3, 0.6-0.9 mm. long, usually connate to the apex, the infra-antheral portion of the androecium 0.5-1.2 mm. long. Pistillate flowers in clusters of 3-7 in racemes to 5 cm. long; pedicels 0.5-3 mm. long; tepals connate, with simple or few-branched hairs, the 1-carpellate ovary with a subsessile obscurely 2-cleft stigma. Fruits 1-5 per inflorescence, on pedicels 5-8 mm. long, the glabrescent ligneous pericarp ultimately dehiscing longitudinally into 2 valves, subglobose to ellipsoid, 18-30 mm. long, 16-21 mm. broad; seed ellipsoid to subglobose, the aril laciniate.

Guatemala to Panama.

CHIRIQUÍ: Progreso, *Cooper & Slater 175;* Almirante region, *Cooper & Slater 24.* DARIÉN: foothills of Garagará, Sambú basin, southern Darién, 30-500 m., *Pittier 5623.*

The assignment of *Pittier 5623* to this species is somewhat doubtful. The cuneate leaf bases, with the secondary veins somewhat distantly spaced, suggest a tendency to intergrade with Central American variants of *Virola sebifera.* The specimen certainly departs from typical *Virola koschnyi* and probably merits varietal status, but the thick pericarp of the fruits tends to corroborate its determination as *Virola koschnyi.*

Figure 170. *Virola sebifera*

3. Virola nobilis A. C. Smith, in Brittonia 2: 490. 1937.

Dioecious trees to 65 m., the younger branchlets sparsely puberulent with canescent hairs, glabrescent. Leaves glabrous above, with fugaceous canescent sessile-stellate hairs below, coriaceous, narrowly oblong, apically short-acuminate, basally acute to attenuate, 9-16 cm. long, 2.3-4 cm. broad, the secondary veins 25-30 per side, the tertiary veins rather obscure; petioles canaliculate, puberulent, 5-10 mm. long, 1-2 mm. broad. Staminate fascicles in panicles up to 4 cm. long, the bracts deciduous, 3-5 mm. long; anthers 3, ca. 0.8 mm. long, connate to apex, the infra-antheral portion of the androecium 0.1-0.3 mm. long. Pistillate flowers in clusters of 3-several in racemes up to 5 cm. long, the connate tepals densely puberulent with much-branched hairs; ovary 1-carpellate, with a subsessile obscurely 2-cleft stigma. Mature fruits 3-8 per inflorescence; pedicels 6-9 mm. long; pericarp densely puberulent, ultimately dehiscing longitudinally into 2 valves, short-stipitate, ellipsoid, 19-32 mm. long, 14-22 mm. broad; aril laciniate, the seed ellipsoid.

Known only from the Canal Zone and adjacent Panama.

canal zone: back of clearing at laboratory, Barro Colorado Island, *Wetmore, Abbe & Shattuck 155;* hills north of Frijoles, *Standley 27507;* Barro Colorado Island *Aviles 29;* clearing, Barro Colorado Island, *Shattuck 694;* Barro Colorado Island, *Carpenter 43.* panamá: Cerro Azul, *Dwyer 1530.*

4. Virola guatemalensis (Hemsl.) Warb. in Nov. Act. Acad. Leop.-Carol. 68: 220. 1897.

Myristica guatemalensis Hemsl. Biol. Centr.-Am. Bot. 3: 66. 1882.

Virola laevigata Standl. in Field Mus. Publ. Bot. 4: 209. 1929.

Dioecious trees to 30 m., the younger branchlets puberulent with evanescent ferruginous or cinereous hairs. Leaves glabrous above, sparsely puberulent with fugaceous sessile-stellate hairs below, coriaceous, oblong to narrowly obovate, apically acuminate or cuspidate, basally attenuate to obtuse, 13-25 cm. long, 4-8 cm. broad; secondary veins 14-21 per side, the tertiary veins rather obscure; petioles canaliculate, 5-14 mm. long, 1-3 mm. broad. Staminate fascicles in many-flowered panicles 5-12 cm. long and nearly as broad; pedicels 0.5-1.5 mm. long, subtended by a conspicuous discoid expansion of the peduncle; bracts deciduous, 2-3 mm. long; perianth tardily 3-parted, ca. 2 mm. long; anthers 3, 0.6-0.8 mm. long, connate to apex, the infra-antheral portion of the androecium 0.4-0.7 mm. long. Pistillate flowers in few-flowered racemes 5-9 cm. long; tepals densely tomentose with ferruginous stellate or branched, fugaceous hairs; ovary 1-carpellate with a subsessile obscurely 2-cleft stigma. Fruits 1-5 per inflorescence; pedicels 5-10 mm. long, the glabrescent, ligneous pericarp ultimately dehiscing longitudinally into 2 valves, ovoid-ellipsoid, 27-36 mm. long, 21-27 mm. broad; aril deeply laciniate, the seed ellipsoid.

Guatemala to western Panama.

chiriquí: Progreso, *Cooper & Slater 308.*

Standley and Steyermark (in Field Mus. Publ. Bot. 24[4]: 298. 1946) report several uses for this species in Guatemala: the seeds are employed in flavoring

beverages, oil expressed from the seeds is utilized in candle-making, and branches with the characteristic whorl of branchlets are used as egg beaters. A. C. Smith (in Brittonia 2: 499. 1937) lists *cacao volador, quieche, sangre fruta dorado* and *bogamani* as common names for this Central American species.

5. VIROLA ELONGATA (Benth.) Warb. in Ber. Deutsch. Bot. Ges. 13: 89. 1895, hyponym; in Nov. Act. Acad. Leop.-Carol. 68: 178. 1897.

Myristica elongata Benth. in Hooker's Journ. Bot. & Kew Misc. 5: 5. 1853.
Myristica punctata Benth. loc. cit. 6. 1853.
Myristica theiodora Benth. loc. cit. 1853.
Myristica cuspidata var. *rufula* A. DC. in DC. Prodr. 14: 696. 1857.
Virola elongata var. *punctata* (Benth.) Warb. in Nov. Act. Acad. Leop.-Carol. 68: 179. 1897.
Virola elongata var. *longicuspis* Warb. loc. cit. 1897.
Virola elongata var. *subcordata* Warb. loc. cit. 180. 1897.
Virola rufula Warb. loc. cit. 181. 1897.
Virola theiodora (Benth.) Warb. loc. cit. 187. 1897.

Dioecious shrubs or small trees to 25 m., the younger branchlets puberulent with ochraceous evanescent hairs. Leaves glabrous above, sparsely puberulent below with fugaceous sessile stellate hairs, subcoriaceous, apically acute to acuminate, basally obtuse to acute, 7-32 cm. long, 1.5-11.0 cm. broad; secondary veins 9-20 per side, the tertiary veins obscure; petioles canaliculate, 4-16 mm. long, 1.0-2.5 mm. broad. Staminate fascicles in broad many-flowered panicles 4-18 cm. long, 3-15 cm. broad; pedicels 2-3 mm. long, the subtending peduncle not conspicuously expanded; bracts deciduous, 2-3 mm. long; perianth tardily 3(-4) parted, 1.5-3.0 mm. long; anthers 3(-6), 0.6-1.6 mm. long, connate to apex or distally divergent, the infra-antheral portion of the androecium 0.2-0.6 mm. long. Pistillate flowers few in racemes 4-7 cm. long; tepals densely tomentose with ochraceous, stellate fugaceous hairs; ovary 1-carpellate with a subsessile, obscurely 2-cleft stigma. Fruits 5-40 per inflorescence; pedicels 2-5 mm. long, the glabrescent ligneous pericarp ultimately dehiscing longitudinally into 2 valves, ellipsoid or subglobose, 11-16 mm. long, 8-12 mm. broad; aril deeply laciniate, the seed ellipsoid.

Panama to Amazonian Brazil and Peru.

CANAL ZONE: area west of Limón Bay, Gatún Locks and Gatún Lake, *Johnston 1796.*

The fruits of the Panama specimen are apparently malformed but the indument and venation of the leaves compare favorably with more southern representatives of the species, formerly not known from Central America.

MONIMIACEAE

By J. A. DUKE

Aromatic, often lemon-scented shrubs or small trees. Leaves mostly opposite, rarely ternate or subalternate, exstipulate, penninerved, entire or irregularly dentate, membranaceous to coriaceous, glabrous to densely pubescent with simple or stellate hairs. Flowers unisexual (in America), perigynous, mostly dioecious, actinomorphic or asymmetrical, in axillary dichotomous or trichotomous cymes or rarely solitary,

the pedicellate hypanthia urceolate to campanulate. Staminate flowers with few to several tepals, these usually uniseriate, often reduced to a subentire annulus encircling the hypanthium; stamens 2-many, the outer often broader and occasionally sterile, the anthers oblong and valvate, or hippocrepiform and longitudinally dehiscent (in North America), the filaments occasionally with a pair of lateral appendages; pistillodes usually absent. Carpellate flowers usually fewer and larger than the staminate; tepals 4-several, occasionally caducous and leaving a repand discoid hypanthium exposing the several separate carpels, more frequently persistent at the summit of the fleshy hypanthium tube (valve) in which the carpels are permanently imbedded. Fruiting carpels several, 1-seeded, free or imbedded in the hypanthium, the seeds mostly erect in the drupaceous or coriaceous carpels.

Confined largely to the tropics of both hemispheres, this family of some 30 genera is represented in North America by only 2. In the Americas the family is of only casual economic importance, with the Brazilian *Mollinedia schottiana* (Spreng.) Perk. and the Chilean *Peumus boldus* Mol. finding a limited demand in the timber trade. Some aromatic species are used in making teas supposed to have medicinal virtues. Considerable phylogenetic significance has been attributed to the combination of magnoliaceous and lauraceous characters in the family, which, according to the anatomical findings of Garratt (in Trop. Woods 39: 18. 1934), is more nearly lauraceous.

Specific determinations in the American representatives are very difficult and a revision of existing specific concepts will ultimately be necessary. If one adopts the narrow concept followed by Perkins (in Engl. Pflanzenreich 4. Fam. 101. 1901), he will discover still many undescribed species in the Americas. Too often Perkins' key characters are based on indumental and numerical variations. More reliable characters should be incorporated into a much-needed reorganization of this puzzling family.

a. Anthers oblong, valvately dehiscent; tepals of the pistillate flowers 4-several, usually persistent, the fruits enclosed in the hypanthium; leaves glabrous or with simple or stellate hairs ..... 1. Siparuna.

aa. Anthers hippocrepiform, longitudinally dehiscent; tepals of the pistillate flowers 4, soon deciduous, the fruits not enclosed in the hypanthium; leaves glabrous or with simple hairs ..... 2. Mollinedia.

1. SIPARUNA Aubl.

Siparuna Aubl. Hist. Pl. Guian. Fr. 2: 864. 1775.

Citrosma Ruiz & Pavón, Fl. Per. & Chil. Prodr. 134. 1794.

Leonia Mutis, ex Kunth, Synops. Pl. 1: 462. 1822.

Conuleum A. Rich. in Act. Soc. Hist. Nat. Paris 1: 391. 1823.

Citriosma Tul. Monogr. 311. 1855.

Angelina Pohl, ex Tul. loc. cit. 363. 1855.

Dioecious or monoecious aromatic shrubs or small trees. Leaves usually opposite, glabrous to densely hairy, the hairs simple or stellate, the blades membrana-

ceous to pergameneous, entire to irregularly dentate. Flowers pedicellate to subsessile, usually in axillary dichotomous or trichotomous cymes, the hypanthium often surmounted by an annular fusion of the tepal bases. Staminate flowers 3-many, with 4-8 subequal exappendiculate tepals united below to form an annulus interior to which is often a flat or hemispherical, apically perforate velum; stamens 1-many, scattered or in circular disposition, the filaments often dilated or conduplicate, the anthers oblong, valvate. Carpellate flowers similar to the staminate but usually fewer and larger; annulus and velum often present; carpels 4-many, the styles elongate, usually exserted, often basally connate. Fruits drupaceous or coriaceous, permanently enclosed in the accrescent hypanthium; seeds tuberculate, ultimately exposed by the irregular bursting of the aggregate fruit.

A puzzling economically trivial genus of about 100 "species," at least 8 of them found in Panama. Several others are to be found in northern Central America and Mexico, but far more occur in South America.

a. Lower leaf surfaces, young twigs and outer surfaces of the tepals hirsute or densely tomentose with a matted indument; plants dioecious; stamens 4-31.
  b. Stamens 8-30; leaves tomentose with a velvety indument, mostly 8-16 mm. broad ..... 1. S. PAUCIFLORA.
  bb. Stamens 4-6; leaves hirsute or, if tomentose, less than 8 cm. broad:
    c. Leaves tomentose, equilateral, entire or minutely denticulate. 2. S. GRISEO-FLAVESCENS.
    cc. Leaves hirsute, often falcate, denticulate, some of the teeth at least 1 mm. long ..... 3. S. TONDUZIANA.

aa. Lower leaf surfaces, young twigs and outer surfaces of the tepals glabrous or with scattered appressed stellate hairs; plants dioecious or monoecious; stamens 2-14:
  d. Leaves pergameneous, entire; plants monoecious; stamens (8-)10-14; velum lacking, the tepals erect, usually obscure in fruit ..... 4. S. GUIANENSIS.
  dd. Leaves membranaceous, if pergameneous denticulate; plants dioecious; stamens 2-8; velum present, the tepals erect or reflexed, usually obvious in fruit:
    e. Stamens 4-8; leaves denticulate or, if entire, mostly more than 8 cm. long:
      f. Leaves denticulate; outer circle of stamens separate or connivent:
        g. Outer circle of stamens connivent; leaves equilateral, 10-20 cm. long ..... 5. S. TETRACEROIDES.
        gg. Outer circle of stamens not connivent; leaves falcate, mostly 5-10 cm. long ..... 6. S. RIPARIA.
      ff. Leaves entire, outer circle of stamens not connivent.... 7. S. NICARAGUENSIS.
    ee. Stamens 2; leaves entire, less than 8 cm. long ..... 8. S. DIANDRA.

1. SIPARUNA PAUCIFLORA (Beurl.) A. DC. in DC. Prodr. 16²: 696. 1868.

Citriosma pauciflora Beurl. in Vet. Akad. Handl. Stockh. 1854: 144. 1856.

Siparuna cauliflora Hemsl. Biol. Centr.-Am. Bot. 3: 69. 1882.

Dioecious aromatic shrubs or small trees to 10 m., often branching from the base, the ultimate branchlets terete to quadrangular, gray-tomentose, the hairs to

0.5 mm. long. Leaves opposite, membranaceous to subpergameneous, narrowly elliptic to obovate, apically acute to acuminate, basally cuneate to rounded, coarsely serrate to almost entire, densely gray stellate-tomentose below, densely to sparsely so above, the hairs to 0.8 mm. long; blades (10-)15-40 cm. long, (6-)8-16 cm. broad, with 10-16 pairs of lateral veins, the canaliculate petioles 1-6 cm. long. Staminate inflorescence of 5- to 15-flowered subsessile axillary cymes, often cauliflorous, gray to yellow stellate-pubescent throughout; peduncles, 1-6 mm. long; pedicels 2-10 mm. long; tepals connate, forming an undulate subentire annulus; velum conical, 4-5 mm. in diameter, the apical pore 1.0-1.5 mm. in diameter; stamens (8-)12-30, the outermost filaments dilated, ovate to orbicular, ca. 1 mm. long, the valvate anthers minute, introrse, usually slightly exserted. Carpellate inflorescences similar to the staminate but the cymes usually sessile, the 3-15 pedicels 2-10 mm. long; tepals connate forming an undulate annulus, the velum ultimately concave, the many separate styles scarcely exserted through the orifice. Aggregate fruits ecallose, globose, capped by the persistent annulus, yellowish-green, drying black, 10-15 mm. in diameter, bursting irregularly exposing the pinkish interior and the several tuberculate seeds.

Peru to Colombia and Costa Rica, mostly at low elevations; called *limoncillo* in Costa Rica.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel 162, 1968, 2085, 2165;* Almirante region, *Cooper & Slater 69;* Daytonia Farm, region of Almirante, *Cooper 422;* Farm Six, Changuinola valley, *Dunlap 489.* CANAL ZONE: Mojinga Swamp near mouth of R. Chagres, below 1 m., *Allen 908;* Barro Colorado Island, *Ebinger 62, Kenoyer 469, Standley 31297, 31301, 31428, 40854, Wilson 32;* Chagres, Isthmus of Panama, *Fendler 196;* Gatún, *Sutton Hayes s. n.;* area west of Limón Bay, Gatún Locks and Gatún Lake, *Johnston 1711;* 1-3 mi. from Gorgona above the reservoir, 40-150 m., *Maxon 4742;* vicinity of Frijoles, *Piper 5283;* near old Fort Lorenzo, mouth of R. Chagres, *Piper 5913;* around Las Cruces, 20-100 m., *Pittier 2620;* along Caño Quebrado, *Pittier 6660.* COCLÉ: north rim of El Valle de Antón, 600-1000 m., *Allen 1636.* COLÓN: forests around Porto Bello, 5-100 m., *Pittier 2430;* between France Field, Canal Zone and Cativa1, Province of Colón, *Standley 30300.* DARIÉN: banks of Río Paca, *Stern, Chambers et al 715;* vicinity of Campamento Buena Vista, R. Chucunaque above confluence with R. Tuquesa, *Stern, Chambers et al 829;* Cana-Cuasi Trail (Camp 2), Chepigana, 2000 ft., *Terry & Terry 1474.* PANAMÁ: Cerro Azul, *Dwyer 1523;* R. Tecumen, *Standley 26752, 29348;* R. Tapía, *Standley 28265;* Juan Díaz, *Standley 30588.*

2. SIPARUNA GRISEO-FLAVESCENS Perk. in Engl. Bot. Jahrb. 38: 693. 1901.

Dioecious shrubs 2-3 m. high, the ultimate branches terete and densely yellowish- or grayish-tomentose, the hairs ca. 0.5 mm. long. Leaves opposite, membranaceous, densely yellow stellate-tomentose below, scantily so above, the hairs ca. 0.5 mm. long; blades oblong to obovate, apically acuminate, basally rounded to subcordate, entire or minutely denticulate, 10-17 cm. long, 4-8 cm. broad, with 9-11 pairs of secondary veins, the canaliculate petioles 1-4 cm. long, densely yellow-tomentose. Staminate inflorescences of 2- to 8-flowered axillary corymbiform cymes, yellow-tomentose except for the velum; peduncles ca. 5 mm. long, the pedicels ca. 1 mm. long; tepals 4, minute, rounded, glabrous within; velum more or less flat, 3-5 mm. in diameter, the aperture ca. 1 mm. in diameter; stamens 6, exserted, the outermost much broader than the innermost. Carpellate in-

florescences of usually 2 2- to 4-flowered cymes in each axil, densely yellow-tomentose except for the velum, the peduncles 2-4 mm. long, the pedicels 2-3 mm. long; tepals connate forming an entire or undulate repand annulus; velum convex, ca. 3 mm. in diameter, the aperture ca. 1 mm. in diameter, the 12-18 styles clearly exserted and tending to be connate at the aperture. Fruits not seen ("red" *fide* Standley, in Field Mus. Publ. Bot. 18[2]: 449. 1937.)

Costa Rica to Panama.

CHIRIQUÍ: between Hato del Jobo and Cerro Vaca, eastern Chiriquí, 700-1000 m., *Pittier 5404.*

The specimen cited, determined by Standley as *S. griseo-flavescens*, is carpellate, but agrees well with Perkins' description of the species, based on a staminate plant (*Pittier 1879* from Costa Rica). *Siparuna patelliformis* Perk. would seem to be very closely allied indeed.

3. SIPARUNA TONDUZIANA Perk. in Engl. Bot. Jahrb. 31: 746. 1902.

Dioecious aromatic shrubs or small trees to 8 m., the ultimate branches terete, reddish-brown, hirsute with yellow to orange, mostly simple hairs to 3 mm. long. Leaves opposite, membranaceous, densely hirsute, at least below, with mostly simple hairs to 3 mm. long; blades elliptic to oblong-obovate, mostly inequilateral, apically long-acuminate, basally cuneate to cordate, coarsely and irregularly denticulate, 8-28 mm. long, 4-10 mm. broad, with 10-15 pairs of secondary veins, the terete to canaliculate petioles 0.5-3 cm. long. Staminate inflorescences usually 2 in each axil, corymbiform, with 3-7 flowers, or subspiciform with 3-15 flowers, the branching often unequal, yellow-pubescent throughout except for the velum; peduncles 4-15 mm. long, the pedicels 0-6 mm. long; tepals mostly 5-6, minute, ultimately forming a repand undulate annulus, the velum convex, 3-4 mm. in diameter, the aperture 1-1.5 mm. in diameter; stamens mostly 6, separate, the outer 4 broader and flatter, usually exserted, ca. 1 mm. long, the valvate anthers minute, introrse. Carpellate inflorescences like the staminate but the flowers usually fewer and slightly larger; styles 8-20, connivent near the apical aperture. Aggregate fruits callose, subreniform, capped by the minute lobate annulus, pinkish-red, ca. 10 mm. long and 15 mm. broad, bursting irregularly and exposing the pinkish interior and the tuberculate seeds.

Panama to Guatemala, where it is called colloquially *salvia* and *cerbatanero.*

BOCAS DEL TORO: Cricamola Valley, region of Almirante, *Cooper 194;* Buena Vista Camp on Chiriquí Trail, region of Almirante, alt. 1250 ft., *Cooper 596;* without locality, *Von Wedel 170.*

4. SIPARUNA GUIANENSIS Aubl. Hist. Pl. Guian. Fr. 2: 865. 1775.

Citrosma discolor Poepp. & Endl. Nov. Gen. & Sp. 2: 48. 1817.

Citriosma guianensis (Aubl.) Tul. Monogr. 361. 1855.

Cistriosma guianensis β *nuda* Tul. loc. cit. 362. 1855.

Citriosma guianensis γ *divergentifolia* Tul. loc. cit. 1855.

Siparuna panamensis A. DC. in Journ. Bot. 3: 219. 1865.
Siparuna discolor A. DC. in DC. Prodr. 16²: 656. 1868.
Siparuna guianensis β *glabrescens* A. DC. loc. cit. 654. 1868.
Siparuna guianensis γ *longifolia* A. DC. loc. cit. 1868.
Siparuna guianensis δ *divergentifolia* A. DC. loc. cit. 1868.
Siparuna foetida Barb. Rodr. in Vellosia 2¹: 68. 1891.
Siparuna guianensis var. *nitens* O. Ktze. Rev. Gen. 3²: 276. 1898.

Monoecious aromatic shrubs or trees to 20 m., the ultimate branches terete or slightly flattened, reddish to greenish-brown, tomentose or glabrescent. Leaves opposite, pergameneous, mostly appressed-strigillose and glabrescent above, stellate-pubescent and glabrescent below; blades oblong to elliptic, apically acute to long-acuminate, basally cuneate to truncate, entire, usually symmetrical, 5-25 cm. long, 3-10 cm. broad, with 7-11 lateral veins on each side, the petioles 5-10(-15) mm. long. Staminate inflorescences hermaphroditic or unisexual, of 2-4 3- to 21-flowered cymes in each axil, yellow stellate-pubescent throughout, often with one conspicuous dichotomous branch to the peduncle, the unbranched portion to 15 mm. long, the pedicels to 3 mm. long; tepals 4-6, deltoid to somewhat hemispherical, the velum lacking; stamens (8-)10-14. Carpellate inflorescences similar to the male, the flowers with several long-exserted, basally connate styles, the velum, if present, obscured by the tepals, conical. Aggregate fruits callose, contorted, obscuring the tepals, pinkish, 8-14 mm. long, 8-14 mm. broad, bursting irregularly and exposing the yellowish interior with its few tuberculate grayish seeds.

Peru and Brazil to Colombia and Costa Rica.

CANAL ZONE: Barro Colorado Island, *Aviles 16, Bangham 457, Shattuck 793, 1074;* Chagres, Isthmus of Panama, *Fendler 188;* area w. of Limón Bay, Gatún Locks and Gatún Lake, road along R. Pina-R. Media divide, *Johnston 1808;* near Ft. Randolph, *Maxon & Harvey 6525;* vicinity of Miraflores Lake, *Peggy White 250.* CHIRIQUÍ: vicinity of San Félix, 100 m., *Allen 3654.* DARIÉN: vicinity of La Palma, 0-50 m., *Pittier 6699.* HERRERA: Ocú, *Ebinger 1091.* PANAMÁ: La Campana, Cerro Campana, *Ebinger 336;* R. Tapía, *Standley 28093, 28296.* VERAGUAS: San Francisco, *Dwyer 1280.*

Standley (in Contr. U. S. Nat. Herb. 27: 182. 1928) reports that in Panama, where it is called *hierba de pasmo,* the plant is supposed to be used as a remedy for colic and as a vermifuge on fowl. This is the only confirmedly monoecious species of the Monimiaceae in Central America, but, when the monoecious condition is not obvious, it is difficult to distinguish from *S. nicaraguensis.*

5. SIPARUNA TETRACEROIDES Perk. in Engl. Bot. Jahrb. 28: 689. 1901.

Dioecious shrubs or small trees, the branchlets terete, reddish, with gray hairs to 0.4 mm. long. Leaves opposite, the blades membranaceous, narrowly elliptic to obovate, apically with a mucronate or emarginate acumen, basally cuneate, marginally undulate-denticulate, 8-20 cm. long, 5-8 cm. broad, glabrescent above, scantily stellate-pilose below, with 8-12 pairs of arcuately ascending veins, the petiole gray-pilose, 2-5 cm. long. Staminate inflorescences of few-flowered cymes mostly paired in the axils of the leaves, with gray stellate hairs, the peduncles

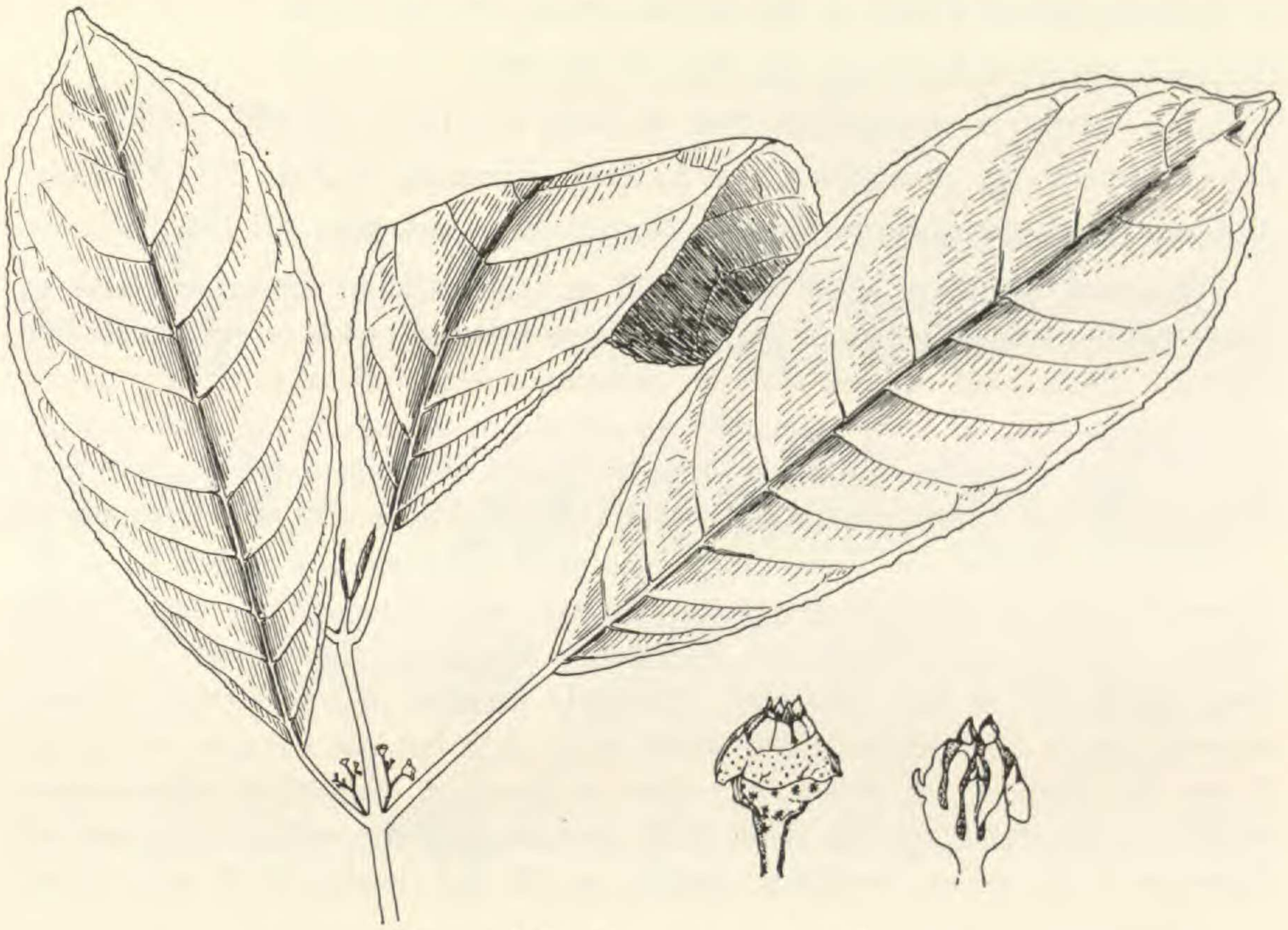

Figure 171. *Siparuna tetraceroides*

2-4 mm. long, the pedicels 1-3 mm. long; flowers rotate, ca. 2 mm. in diameter, the receptacle obconic, the tepals obsolescent, ultimately connate and repand, the velum hemispheric, the orifice ca. 1 mm. in diameter, stamens 5-8, the 4 exterior in a whorl and often connate or connivent, 1.5-2.2 mm. long, the anthers minute, introrse, exserted. Carpellate inflorescences similar to the staminate, perhaps fewer-flowered, the tepals obscure, deltoid, ultimately forming an undulate annulus, the styles more or less connivent at the aperture. Fruits callose, reniform, capped by the persistent tepals.

Costa Rica to western Panama.

CHIRIQUÍ: between El Hato (Volcán) and Costa Rica, *Ebinger 813;* Puerto Remedios, 0-30 m., *Pittier* 3386*;* in forest, Cerro de la Plata, near San Félix, eastern Chiriquí, 12-150 m., *Pittier 5156.*

The cited Panama specimens depart rather radically from Costa Rican material and might be deserving of some nomenclatural status. Panama material has more delicate, less coarsely toothed leaves, and the veins are not so conspicuously yellow as those specimens from Costa Rica which I believe to be properly called *S. tetraceroides* (*Pittier 16144,* cited by Perkins, and *Skutch 2220, 3813, 3985*). The staminate Panama plant (*Pittier 5156*), illustrated in Fig. 171, has the outer whorl of stamens connate, and in this respect represents an approach to the Colombian *S. steleandra* Perk.

6. Siparuna riparia (Tul.) A. DC. in DC. Prodr. 16²: 647. 1868.

Citriosma riparia Tul. in Ann. Sci. Nat. 4³: 36. 1855.
Siparuna riparia var. *macrophylla* Perk. in Engl. Bot. Jahrb. 28: 690. 1901.
Siparuna riparia var. *grandiflora* Perk. in Engl. Pflanzenr. 4. Fam. 101: 99. 1901.
Siparuna riparia var. *calantha* Perk. in Notizbl. Bot. Gart. Berl. 10: 164. 1927.

Dioecious shrubs or small trees to 6 m., the ultimate branches terete or quadrangular, reddish-brown or gray, tomentose with yellowish or grayish stellate hairs to 1 mm. long. Leaves opposite, membranaceous, pilose, especially below, with stellate hairs to 1 mm. long; blades elliptic to obovate, often inequilateral, apically acute to caudate-acuminate, basally cuneate to truncate, serrate, 5-12 mm. long, 3.5-6.0 cm. broad, with 8-10 lateral veins on either side, the subterete to canaliculate petioles 1.0-3.5 cm. long. Staminate inflorescences of 2-3 3- to 15-flowered cymes in each axil, grayish to yellowish stellate-pubescent except for the velum; peduncles mostly 4-10 mm. long before branching, the pedicels 3-12 mm. long; tepals 4-7, at first triangular, ultimately rounded and somewhat reflexed; stamens mostly 5-6, the outer 4 disposed in a circle but not connate; velum ca. 2 mm. in diameter, the orifice ca. 1 mm. in diameter. Carpellate inflorescences similar to the staminate, the styles 6-12, connate near the orifice, long-exserted. Aggregate fruits callose, reniform, reddish, ca. 10 mm. broad, 10-15 mm. broad.

Mexico to Colombia.

chiriquí: rain forest, Bajo Chorro, 6000 ft., *Davidson 242;* vicinity of Bajo Mona and Quebrada Chiquero, 1500 m., *Woodson & Schery 600.*

The identity of the cited specimens is not without question. Although Perkins has said that the stamens are 10-12 in *S. riparia, Bourgeau 1748,* identified by Perkins as *S. riparia,* has 5-6 stamens, and I believe the latter numbers to be more prevalent.

7. Siparuna nicaraguensis Hemsl. Biol. Centr.-Am. Bot. 3: 69. 1882.

Dioecious aromatic shrubs or small trees to 8 m., the ultimate branches terete, ferruginous stellate-pubescent, the hairs evanescent. Leaves opposite, membranaceous, glabrous or subglabrous above, scantily stellate-pubescent to subglabrous below; blades elliptic to obovate, apically more or less acuminate, marginally entire to undulate or minutely denticulate, 6-22 cm. long, 3.5-12.0 cm. broad, with 5-10 lateral veins on either side, the canaliculate petioles 1-9 cm. long. Staminate inflorescences with 1-4 1- to many-flowered cymes in each axil, grayish- to yellowish-puberulent except for the inner portion of the tepals and the velum; peduncles 1-15 mm. long, the pedicels 1-5 mm. long; tepals (3-)4-7, basally connate, the lobes free, rounded or deltoid; velum 2-4 mm. broad, the pore ca. 1 mm. in diameter; stamens 5-8, the outer 4 or 5 separate, occasionally disposed in a circle embracing the inner 1-3 which are often conduplicate, ca. 1 mm. long; anthers valvate, minute, introrse. Carpellate inflorescences similar to the staminate but with fewer flowers, only 1 in a given cyme usually developing into fruit, the numerous styles exserted ca. 0.5 mm. Aggregate fruits smooth or slightly callose, capped by the

Figure 172. *Siparuna nicaraguensis*

persistent erect tepals, orange to red, 10-20 mm. in diameter, bursting irregularly to expose the several tuberculate seeds.

Panama to Mexico.

BOCAS DEL TORO: region of Almirante, *Cooper 616*. COCLÉ: north rim of El Valle, *Allen 1841;* north rim of El Valle de Antón, near Cerro Turega, 650-700 m., *Woodson & Schery 159*. CANAL ZONE: Ancon Hill, *Duke 4610*. COLON: in forest, Loma de la Gloria, near Fató (Nombre de Dios), 10-104 m., *Pittier 4077*. DARIÉN: along the Sambú River, southern Darién, above tide limit, *Pittier 5553;* vicinity of Cana, alt. 1750 ft., *Stern, Chambers et al 468, 690;* Paca, below Cana, *Williams 718*. PANAMÁ: La Campana, Cerro Campana, *Ebinger* 333.

The aromatic leaves of this species, known in various places in Central America as *cerbatana, chuché, hormiguillo, kex, limoncillo, salvia,* "wild coffee" and *yaya de mono,* are locally brewed to form a tea supposedly remedial for respiratory ailments.

Material from Darién, as illustrated in Fig. 172, departs rather disconcertingly from most Central American specimens referred to this species. Both Standley and I have suffered the temptation to treat such Darién material as a new taxon differing from typical *S. nicaraguensis* in having the shorter male tepals subdeltoid and erect at anthesis and uncommonly large leaves and petioles. Such variation is more common to the south but may be found also in specimens from Mexico and northern Central America. It is for that reason that I am reluctant to recognize the variants formally.

Figure 173. *Siparuna diandra*

8. SIPARUNA **diandra** J. Duke sp. nov.

Frutices dioeci 2-4 m. alti ramulis teretibus ferrugineis griseo-pilosiusculis pilis glandulosis ad 0.3 mm. longis. Folia plerumque opposita lamina membranacea obovata vel subelliptica apice caudate acuminata basi attenuata cuneatave utrinque parce stellato-pilosiuscula integra nervis lateralibus plerumque 6-8 arcuate ascendentibus in utroque latere petiolo griseo-pilosiusculo 5-10 mm. longo. Inflorescentiae masculae pauciflorigerae corymbosae in axillis foliorum partibus exterioribus parce grisiter stellateque pilosiusculis pilis ad 0.3 mm. longis pedunculo plerumque 1.0-1.5 mm. longo pedicellis 1.0-3.5 mm. longis. Flores rotati receptaculo obconico ca. 1.0-1.5 mm. in diam. tepalis plerumque 4 triangularibus erectis nigrescentibus ca. 0.5 mm. longis intus glabris; velo tholiforme ore parvissimo staminibus 2 carinatis cucullatisque carnosis glandulosis ad 1.5 mm. longis vix exsertis. Flores feminei nunc ignoti.

DARIÉN: Cana-Cuasi Trail (Camp 2), Chepigana, 2000 ft., Mar. 11, 1940, *Terry & Terry 1496* (HOLOTYPE, MO).

An interesting addition to the flora of Panama, this peculiar species seems to have no close allies in Central America. Among South American species, it would seem to be most closely related to the Peruvian *S. gilgiana* Perk., which differs in having much larger leaves and petioles and the tepals connate into a repand flange, and the Brazilian *S. brasiliensis* Perk., which also has larger leaves, petioles and peduncles.

2. MOLLINEDIA Ruiz & Pavón

MOLLINEDIA Ruiz & Pavón, Fl. Peruv. & Chil. Prodr. 83, *t. 15*. 1794.
Tetratome Poepp. & Endl. Nov. Gen. & Sp. 2: 46, *t. 163*. 1838.
Paracelsia Mart. ex Tul. in Mart. Fl. Bras. 4[1]: 314. 1857.

Dioecious shrubs or small trees. Leaves opposite, glabrous or slightly pilose below, membranaceous to coriaceous, petiolate, exstipulate, entire or irregularly dentate, with few secondary veins confluent at some distance from the margin. Flowers pedicellate, solitary, cymose or corymbiform in the axils, the hypanthium campanulate or urceolate, glabrous or pubescent, the hairs simple. Staminate flowers 3-many per inflorescence, with 4 tepals, the 2 inner frequently smaller and provided with a terminal laciniate appendage; stamens 8-many, included on the inner surface of the hypanthium, the filaments minute, the anthers (in Central America) hippocrepiform, longitudinally dehiscent. Carpellate flowers mostly 1-3 per inflorescence, the 4 petals soon deciduous from the urceolate hypanthium; carpels 6-many, glabrous to pilose, ellipsoid, the styles filiform. Drupes fleshy or coriaceous, sessile or stipitate on the reflexed undulate hypanthium.

With the exception of 1 dubious Australian species, all of the nearly 75 species of this genus are found in tropical and subtropical America. Economically unimportant, the genus is taxonomically perplexing and little can be done to correct this until a monographic study is undertaken. Four of about 15 Central American species occur in Panama.

a. Leaves ovate to obovate, basally rounded to cuneate, weakly toothed; fruits drying black or brown, scarcely stipitate:
  b. Drupes smooth, glabrous, drying black; leaves glabrous, acuminate; branchlets glabrous ..... 1. M. DARIENENSIS.
  bb. Drupes corrugated, often puberulent, drying brown; leaves puberulent, rarely glabrescent, obtuse to shortly acuminate; branchlets pubescent ..... 2. M. COSTARICENSIS.

aa. Leaves lanceolate to rhomb-elliptic, basally cuneate, often strongly toothed; fruits drying brown, occasionally long-stipitate:
  c. Drupes 10-13 mm. long, sessile or obscurely stipitate; leaves membranaceous, usually puberulent; plants dioecious ..... 3. M. PINCHOTIANA.
  cc. Drupes 15-20 mm. long, on stipes 1-3 mm. long; leaves pergameneous, glabrous; plant possibly monoecious ..... 4. M. STIPITATA.

1. MOLLINEDIA DARIENENSIS Standl. in Field Mus. Publ. Bot. 22: 332. 1940.

Dioecious shrubs 1.0-2.5 m. high, the branches glabrous and rather dark in drying. Leaves chartaceous, glabrescent, lance-ovate, apically acuminate, basally cuneate to sub-rounded, 9-16 cm. long, 3-6 cm. broad, with 5-9 irregular teeth on

either side, the secondary veins 4-5 on either side, arcuately anastomosing 2-5 mm. from the margin; petioles ca. 10 mm. long, drying dark brown, glabrous or glabrate. Staminate flowers not known. Carpellate flowers solitary or geminate in the axils of the leaves, the pedicels glabrous or glabrate, ca. 10 mm. long, the peduncles 1-5 mm. long; bracts and bracteoles not apparent; flowers at anthesis not known. Fruits fleshy ellipsoid, rounded at both ends, smooth, drying black, 13-15 mm. long, ca. 10 mm. broad; receptacles reflexed, ca. 10 mm. broad; seeds ca. 12 mm. long, 9 mm. in diameter, the testa mottled.

Panama, known only from the type collection.

DARIÉN: Cana-Cuasi Trail (Camp 2), Chepigana District, 3000 ft., *Terry & Terry 1456.*

2. MOLLINEDIA COSTARICENSIS Donn. Sm. in Bot. Gaz. 33: 257. 1902.

Dioecious shrubs or small trees to 7 m. high, the branchlets pubescent with grayish hairs. Leaves pergameneous, appressed-strigillose, especially below, rarely glabrescent, narrowly to broadly ovate or obovate, apically obtuse to shortly acuminate, basally acute to rounded, 8-18 cm. long, 4-9 cm. broad, subentire or with up to 25 minute irregular teeth on either side, the secondary veins 5-11 on either side, arcuately anastomosing 3-8 mm. from the margin; petioles 5-16 mm. long, drying rufous, puberulent. Staminate inflorescences 1-6 in 3- to 5-flowered cymes in each axil, the bracteate peduncles and pedicels with yellowish puberulence; peduncles 1-20 mm. long, the pedicels 2-5 mm. long. Flowers campanulate, 6-8 mm. in diameter at anthesis; tepals 4, exteriorly with a yellowish puberulence, the inner 2 with an apical laciniate appendage; stamens 16-34, ca. 1 mm. long, the anthers hippocrepiform. Carpellate flowers mostly solitary or paired in the axils, the bracteate peduncles 5-20 mm. long, the bracteolate pedicels to as much as 6 cm. long; flowers turbinate, 2-4 mm. in diameter, the tepals ca. 2 mm. long, caducous, the numerous carpels ellipsoid, with a grayish or yellowish pubescence. Fruiting receptacles discoid, repand, densely strigillose on both surfaces, 10-15 cm. broad; fruits ellipsoid, numerous, brown, corrugated, usually puberulent, 8-13 mm. long, 5-8 mm. broad, the seeds slightly smaller.

Panama and Costa Rica.

CHIRIQUÍ: rain forest, Bajo Chorro, Boquete Distr., 6000 ft., *Davidson 370.*

M. costaricensis is not constantly separated from *M. pinchotiana*, but a summation of the following characters seems to define the former rather well: leaves pergameneous, with the lateral veins prominent below, the base rounded, the apex rounded, acute or briefly and abruptly acuminate, the indument yellowish or grayish, the staminate flowers 6-8 mm. in diameter at anthesis, the stamens 16-34.

3. MOLLINEDIA PINCHOTIANA Perk. in Engl. Bot. Jahrb. 31: 743. 1902.

Dioecious shrubs or small trees to 6 m. high, the branchlets often densely puberulent with evanescent brownish hairs. Leaves membranaceous, glabrous or lightly puberulent, narrowly elliptic to obovate, apically acuminate, basally cuneate, with 5-12 irregular arcuate teeth on either side, 5-16 cm. long, 2-6 cm. broad, with

4-5 lateral veins on either side, these conspicuous to inconspicuous below, arcuately anastomosing 2-10 mm. from the margin; petioles 5-18 mm. long, light brown, puberulent or glabrate. Staminate inflorescences 1-4 in the axil of a leaf, usually of 3-flowered cymes, the bracteate peduncles and pedicels with a grayish or reddish-brown puberulence; peduncles 5-20 mm. long, the pedicels 3-30 mm. long. Flowers campanulate, 4-6 mm. in diameter at anthesis; tepals 4, with grayish or reddish-brown puberulence, the inner 2 with a laciniate apical appendage; stamens 23-36 (44 in some Costa Rican deviates with a pinkish puberulence on the leaves), ca. 1 mm. long, the anthers hippocrepiform. Carpellate flowers mostly solitary in the axils, the bracteate peduncles 3-20 mm. long, the bracteolate pedicels 3-30 mm. long; flowers turbinate, 2-3 mm. in diameter, the acute tepals ca. 2 mm. long, promptly deciduous, the numerous carpels ellipsoid, with a grayish puberulence. Fruiting receptacles discoid, reflexed, puberulent on both surfaces, ca. 8-12 mm. broad; fruits ellipsoid, numerous, brown, carnose, 10-12 mm. long, 6-7 mm. broad, the seeds slightly smaller, brown, mottled with purple.

CHIRIQUÍ: humid forest between Alto de las Palmas and top of Cerro de la Horqueta, 2100-2268 m., *Pittier 3246*.

Apparently Standley at one time considered this specimen to represent a new species. The leaves are rather large and basally rounded and the fruits are immature, but the plant appears to be *M. pinchotiana*, a variable species which grades into several "microspecies" in Costa Rica. At one extreme is a "microspecies," apparently unnamed at present, from the region of Zarcero. This is characterized by narrow rhomb-elliptic leaves with a pinkish indument and the stamens numbering about 40. At the other extreme is *M. minutiflora* Standl. & Williams, with multiflorous male inflorescences, the flowers 1.5-2.5 mm. in diameter at anthesis, the stamens 10-16, the leaves glabrous, elliptic and with few or no teeth. Closely allied to *M. mexicana* Perk. (scarcely distinct from *M. nigrescens* Tul.) is a group of specimens from the vicinity of El General, Costa Rica. This group, to which Standley also applied an herbarium name, is characterized by lanceolate leaves with 2-6 teeth on either side, multiflorous staminate inflorescences, the flowers ca. 3 mm. in diameter, the stamens 16-24 in number. Whether all these should be treated as separate species or merely as components of one polymorphic species is a serious question for the monographer.

4. MOLLINEDIA **stipitata** J. Duke, sp. nov.

Frutices dioeci vel interdum fortasse monoeci ad 3 m. alti ramis griseis subteretibus ramulis glabrescentibus griseis vel rufis. Folia opposita lamina glabra anguste lateve elliptica apice acuta vel acuminata basi cuneata vel acuta in utroque margine denticulata dentibus aristatis 1-5 irregulariter remotis 6-11 cm. longa 15-45 mm. lata utrinque glabra nervis prominentibus lateralibus plerumque 5 in utroque latere prope marginem confluentibus petiolo glabro canaliculato 5-10 mm. longo. Inflorescentiae masculae plerumque 3- vel 5-florigerae binae in axillis foliorum pedunculis bracteatis 10-14 mm. longis pedicellis ca. 5 mm. longis. Flores rotati ca.

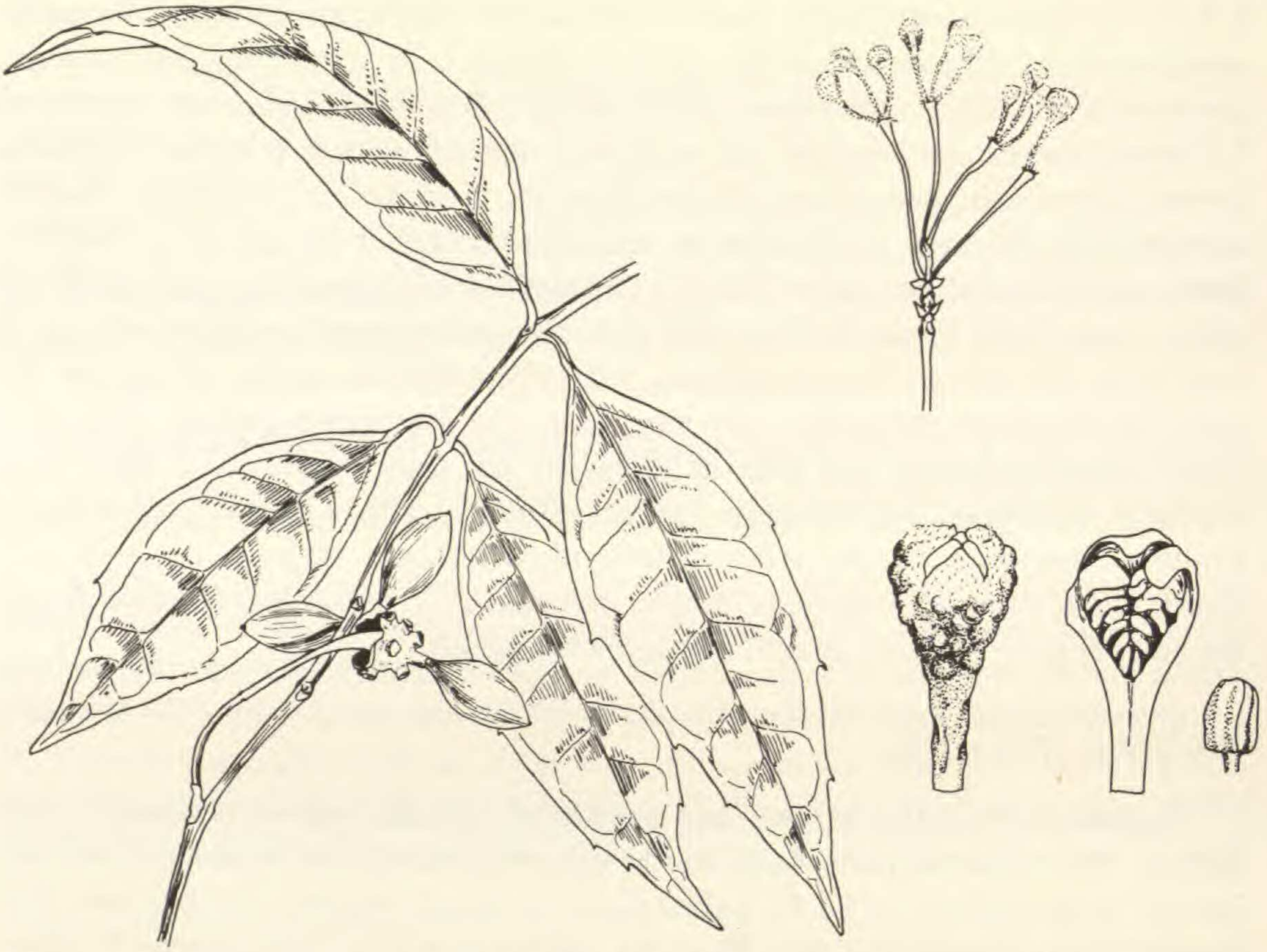

Figure 174. *Mollinedia stipitata*

2 mm. in diam. tepalis 4 glabris 2 interioribus laciniose appendiculatis staminibus ca. 26 1.0-1.5 mm. longis antheris hippocrepiformibus. Inflorescentiae femineae plerumque uniflorae solitariae vel binae in axillis foliorum pedunculis bracteatis ca. 8 mm. longis pedicellis bracteolatis ca. 10 mm. longis. Flores ca. 4 mm. in diam. glabri tepalis 4 ca. 2 mm. longis mox deciduis carpellis ca. 20 separatis stylis longis. Receptacula fructifera disciformia repanda 7-15 mm. lata pedunculo cum pedicello 10-45 mm. longo drupis stipitatis fuscis striatis ellipsoideis mucronatis 16-20 mm. longis ca. 10 mm. latis basem attenuatis.

CHIRIQUÍ: between the R. Ladrillo and Los Siguas, southern slope of Cerro de la Horqueta, 1200-1700 m., *Pittier 3280* (HOLOTYPE, NY); cloud forest, Cerro Horqueta, 6500 ft., *Von Hagen & Von Hagen 2064;* humid forest between Alto de las Palmas and top of Cerro de la Horqueta, 2100-2268 m., *Pittier* 3262.

Among North American species this seems most closely related to a specimen from Chiapas (*Matuda 442*) determined by Standley as *M. viridiflora* Tul. Standley's determination is doubtful, however, because a photograph of the type of *M. viridiflora* alarmingly resembles what is currently passing as *M. guatemalensis* Perk., a species with large pergameneous leaves, the staminate flowers 5-8 mm. in diameter at anthesis, with 30-48 stamens and with large short-stipitate drupes. Although Perkins has stated that the stamens in *M. viridiflora* are "usque 24," this seems to

be the only character separating it from *M. guatemalensis*. The new species is readily distinguished by its small narrow leaves, the small male flowers, and the long-stipitate, apically mucronate, basally attenuate drupes.

The Von Hagen specimen poses an interesting problem as it consists of both staminate and carpellate branches. Their data say "tree, 8 ft tall." By the singular usage of tree, we would be forced to conclude that the species is sometimes monoecious, but until the physical connection of male and female flowers is verified, this is pure speculation. There are no reports of monoecism in *Mollinedia*, but the condition is not uncommon in *Siparuna*.

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